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ABSTRACT

Computer based assessment was introduced into an introductory economics course at the University of Queensland during the second semester of 1986. Over 600 students used computer generated and graded random tests for a number of assignments. A commercial computer managed learning (CML) software package was used to administer and grade tests and to keep records, generate reports, and provide analyses of student and question bank performance. The effectiveness of the CML approach was evaluated by using evidence from responses to a student questionnaire and by the end-of-year examination. Student acceptance of CML was overwhelming, and the increase in student end-of-year grades after using the system was substantial. CML provides a powerful mechanism for addressing such issues as learning effectiveness, utilization of resources, student motivation, support to students, learner control, and cost-effectiveness. As a result of the success of the implementation of CML in 1986, a much larger scale CML operation was undertaken in 1987, involving a number of semester subjects, and more than 1,600 students taking approximately 49,000 tests throughout the year. It was concluded that the implementation of CML on a wide scale could improve student performance and staff productivity, and that setting up a CML facility can be achieved at affordable cost since the hardware requirements are relatively small. (The student questionnaire is included. Appendixes, which constitute more than one half of the report, include examples of typical module tests, student responses to the questionnaire, and examples of selected CML reports and item analysis options. 22 references) (GL)

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A REPORT ON THE PILOT IMPLEMENTATION OF COMPUTER MANAGED LEARNING IN A FIRST-YEAR INTRODUCTORY ECONOMICS COURSE AT THE DEPARTMENT OF ECONOMICS, UNIVERSITY OF QUEENSLAND, SECOND SEMESTER 1986.

by

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November 1987

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EXECUTIVE SUMMARY

Computer based assessment was introduced into an introductory economics subject, EC110, in the Department of Economics, University of Queensland, during Second Semester 1986. Over 600 students used computer generated and marked random tests for a number of assignments.

A commercial Computer Managed Learning (CML) software package was used to issue and mark student tests and to keep records, generate reports and provide analysis of student and question bank performance. Because tests were answered by students away from the computer, only a small number of terminals were required. The distinction is made between Computer Managed Learning and Computer Assisted Instruction (CAI).

The effectiveness of the CML approach is evaluated by using evidence from the responses to a Student Questionnaire and by the end-of-year examination. Student acceptance of CML was overwhelming, and the increase in student end-of-year marks after using the CML system was substantial.

As considerable administrative/clerical tasks are performed by CML, CML enables human resources to be deployed more effectively, especially for support to students with learning difficulties.

Although this pilot study was conducted with a large group of students (600+), the potential of CML to work effectively with small student numbers should not be ignored, particularly with subjects that are suitable for Resource Based Learning. Such an approach may enable institutions to maintain (or even increase) the range of subjects they offer, in an environment of increasing financial constraint.

CML has the potential to enable institutions to increase their student intakes, for comparatively small costs in additional resources, whilst still being able to provide adequate student support.

The report concludes that CML provides a powerful mechanism for addressing such issues as learning effectiveness, utilization of resources, student motivation, support to students, learner control and cost-effectiveness.

As a result of the success of the implementation of CML in 1986, a much larger scale CML operation was undertaken in 1987, involving a number of semester subjects and over 1600 students taking approximately 49 000 tests throughout the year.

A significant factor in the success of the CML activity was the extent to which students were provided with operational and tutorial support. It is considered that student acceptance of CML is a direct function of such support being provided.

It is recommended that tertiary institutions give serious consideration to the implementation of CML on a wide scale in order to improve student performance and staff productivity. Although initial effort and resources are required to set-up a CML facility, this can still be achieved at affordable cost, particularly as the hardware requirements of a CML approach are relatively small.

1. INTRODUCTION

This report describes the implementation of CML in a large first-year economics course at the University of Queensland in Second Semester 1986. Although the introduction of CML arose from a particular set of circumstances and although CML was initially thought of as a trial run for 1987, CML was very effective and even in its first-up format was successful in promoting student learning. The introduction of CML in 1986 led to much more widespread adoption in the Department of Economics in 1987.

The particular circumstances occurred because one of the authors, Jon Stanford, had returned to lecturing the first-year course in 1985 and was interested in improving student performance and student motivation; as well he had a strong background in instructional design, use of computer simulations, and use of various media and course evaluation at the University level [Stanford (1979), Stanford (1980a), Stanford (1980b), Stanford (1981a), Stanford (1981b), Imrie and Stanford (1981), and Laaser and Stanford (1984)].

The other author, Howard Cook, on secondment to the Computer Assisted Learning (CAL) Unit, University of Queensland, to advise university staff on the application of CML had a strong background in applications of CML for industrial training [Chesmond and Cook (1984), Cook (1984), Miller and Cook (1986), Miller, Cook and Clark (1986), and Chesmond, Cook and Miller 1986)]. Coincidently the Faculty of Commerce and Economics, University of Queensland, had just installed a VAX computer which was available for use. The CAL Unit had purchased a commercial CML software package (CBTS) which operates on the VAX range of computers. Thus all the ingredients required for CML implementation, hardware, software, systems support, instructional design expertise and over 600 students were available. The implementation worked well because the authors were able to work co-operatively and to enlist support from many sources.

The problems of organising, teaching and managing a large first-year course are substantial. Most students in the course enter university direct from school and many find the transition difficult. Many students find sitting in large lecture theatres alienating and in such an impersonal environment lose motivation. Academics are generally swamped by day-to-day concerns of administration of a large course: making sure student handouts are ready on time, dealing with student enquiries, liaising with tutors, setting tests and examination papers, maintaining records of student performance and progress; they are unable to take a detached look at the course and what they should be doing, and are unable to plan rationally for course development and for course innovation.

Australian universities have been under financial pressure for some years and are unable to devote increased resources to overcome these problems. The solution to some of these problems lies in the adoption of a new approach which will encourage students to take greater responsibility for their own learning, to set and achieve their own learning goals and to acquire learning skills which will stand them in good stead during their professional lives.

Consequently the implementation of a CML system within a large course is more than the use of a computer in education; it necessarily embodies the adoption of a different approach to learning and teaching in which the role of the teacher is that of facilitator of learning and manager of learning experiences. As Jon Stanford often remarks "the first thing to learn about computer managed learning is that it has very little to do with computers."

2. DEFINITION OF CML

Computer Managed Learning is defined here as the application where the computer does not have an instructional role and where the function of the computer is in the control, administration and testing of the learning process. Management of learning is the process of course design, specification of learning objectives, issue and marking of tests, recording results of tests, provision of feedback and remedial support, analysis of module effectiveness, analysis of learning performance, preparation of reports to students and lecturers (Miller, Cook and Clark 1986).

There is an important distinction between Computer Managed Learning and Computer Assisted Instruction. Computer Assisted Instruction is taken as the learning process in which instructional material is stored in the computer and released to a student seated at a computer terminal.

Computer Managed Learning is used to refer to the system where instructional material is available only externally to the computer and where the computer plays an important management function. It is possible for a CML system to incorporate Computer Assisted Instruction but it is generally not necessary or even desirable.

This is not to deny the potential of CAI. CAI can be considered as a "bottom-up" approach, where its use has been selected because it provides the most effective delivery strategy for a given learning situation. This could be considered as a "micro-level" application.

CML is a "top-down" approach, where the management of a large number of learning situations is required. This could be a complete course or large group of courses. This could be considered as a "macro-level" application.

3. THE COURSE

The course, EC110 Introductory Economics, is a standard principles course which accounts for 25 per cent of the workload of a full-time student. The course is designed for continuing students in economics; the Department offers, as well, a terminal first-year course for students who do not intend to proceed to the study of economics at second-year level.

The course, EC110 Introductory Economics, is required for all students enrolled in the Faculty of Commerce and Economics (unlike most other Australian universities both the B Com and B Econ degrees are offered by the University of Queensland) and is available to students in other Faculties, especially Arts, who wish to enrol for a non-terminal course in economics. Total nominal enrolment in 1986 was 640.

The major features of the course enrolment can be summarised as follows:

- approximately 50 per cent of students are enrolled for the B Com degree;
- approximately 25 per cent of students are enrolled for the B Econ degree;
- approximately 25 per cent of students are enrolled for the B A degree or another degree;
- the entry requirements for the B Com degree are significantly more stringent than for the other degrees;
- approximately 75 per cent of students have entered direct from Queensland Grade 12;
- a small but significant proportion of students have experience of successful tertiary study; approximately seven per cent of students enrolled hold a tertiary degree.

The course is taught by large lecture format to three self-selected groups two of which are scheduled during the day and the other scheduled in a block in the evening. The course is taught throughout the year i.e. over the two semesters, and is examined by two formal unseen examinations, each of two hours duration, in November.

The lectures are given by three academics; one of whom teaches the First Semester and the other two each teach half of Second Semester. The end-of-year examination is divided into three parts to reflect this division of lecturing effort.

The final grade for the course is determined by a combination of progressive assessment and end-of-year examination with a relatively high weighting towards the end-of-year examination. Although the determination of the final grade is relatively complex it can be conveniently explained in Table 1.

TABLE 1. CONTRIBUTION OF EACH FORM OF ASSESSMENT TO THE FINAL GRADE IN EC110 IN 1986.

Form of Assessment	Number of Marks
First Semester:	
Best Five Class Quiz Marks	25
Two Assignments	10
End-of-Year Examination	65
Second Semester:	
Best Five Class Quiz Marks (Part A & Part B)	25
Assignment - Part A	5
Assignment - CML Test	5*
End-of-Year Examination - Part A	30
End-of-Year Examination - Part B	35**

* There were three CML tests. The first CML test was in lieu of an assignment; the other two CML tests were voluntary; marks were obtained on an "all or nothing" basis.

** This mark was scaled according to the student performance in the final two CML tests.

The procedure is illustrated in Table 2 on the assumption that the maximum marks on the CML tests had been obtained:

TABLE 2. ILLUSTRATION OF SCALING OF END-OF-YEAR EXAMINATION MARKS, PART B, EC110, 1986.

Unadjusted Mark Out of 35 Marks	%	Scaled Mark out of 25	CML Mark	Scaled Mark out of 35	%
35	100	25	10	35	100
30	86	21	10	31	89
26	75	19	10	29	83
25	71	18	10	28	80
23	65	16	10	26	74
20	57	14	10	24	69
18	50	16	10	23	66
15	43	11	10	21	60
10	29	7	10	17	49

In 1986 there were no small group tutorials, as had been the case in previous years. Instead of tutorials, students were required to take a weekly class quiz in the third hour of class time, and the subject of the previous weekly quiz was discussed during the remaining time of the third hour. The quizzes were marked by tutors, but the lag in returning the quiz results was substantial (as much as 6-7 weeks). The innovation was not favourably regarded by students in general. Their complaints about these quizzes and mass tutorials are recorded (often graphically) throughout the comments to the Student Questionnaire (see Appendix B).

3.1 Learning Objectives for the Course

Previous experience with students in EC110 (and with later year economics students) has indicated that, in general, students could perform at high levels in tests involving verbal recall but that in tests requiring the display of other skills they performed at significantly lower levels.

Areas where students have performed at low levels are:

a. identifying the empirical counterpart of concepts understood in verbal terms;
b. drawing logical inferences from verbal statements or from simple data (either hypothetical or real);
c. drawing strong conclusions from verbal statements or from empirical data;
d. performing relatively simple calculations;
e. developing critical analysis of theoretical or empirical topics.

Making use of the CML system was designed to improve student performance in areas a, b, c and d above and it was recognised that other responses were required to improve student performance in area e; in this area students have to acquire skills which involve analysis, selection, discrimination, synthesis, criticism and evaluation.

This implies the use of a two tier approach to learning in which the competence principle was adopted for the first tier where basic level skills are acquired. This approach was seen as appropriate in the course, EC110 Introductory Economics, where competence in basic level skills comprises the great majority of student effort. The competence approach required the division of course material into relatively self-contained modules, with the students being provided with clear cut learning objectives and specific instructions as to how to achieve these objectives. An inability to achieve these objectives at high levels (i.e competence) at the first attempt was not regarded as "failure"; instead learners are "recycled" until they attain competence. This implies that learners may proceed at their own pace in achieving learning objectives although institutional and logistical constraints place limitations on self-pacing.

The achievement of learning objectives at the first tier provide the ground work for acquisition of skills at the second tier level but the tasks set for learners to acquire second tier skills should not involve repetition of tasks used in mastery of first tier skills but should be designed more explicitly to achieve the particular learning objectives of the second tier.

This design of the course uses principles of learning derived from the Keller Plan approach to learning and from the general principles of a Personalised System of Instruction [Keller (1968), Flammer (1971), Koen (1971), Moo-Young (1972), Koen (1973), Baldwin and Goodman (1973), Keller and Sherman (1974), Groves (1976), Jordan (1978), and Imrie, Blithe and Johnston (1980)].

Achievement of the skills in the second tier requires students to write papers on questions involving problem identification, problem analysis and solution. In order to achieve these skills students have to understand how economics works as a system. Assessment of these papers requires detailed comments on the student assignments in the light of pre-announced criteria. The course, EC110, at present, does very little of this.

3.2 Contribution of the CML System to Achieving Learning Objectives

A CML system is able to make a significant contribution to assisting students to achieve the learning objectives of the course in the following ways:

i. by generating unique tests for each student
ii. by marking the tests immediately
iii. by allowing the lecturer to monitor individual student progress through the course
iv. by recording student marks and other data
v. by providing various reports
vi. by providing detailed statistical analysis of student performance
vii. by generating detailed statistical analysis of the answers to items in the test bank so that testing procedures can be modified in the light of experience and of revealed difficulty.

A CML system offers significant advantages in that computers have a distinct advantage over people in doing repetitive tasks, in recording data and in undertaking large calculations and in collating information.

The testbank consisted of the following style of questions:

i. true/false
ii. multiple choice
iii. matching
iv. completion
v. calculations.

Some typical questions and their relationship to the learning objectives are given:

Matching Question:
"Consider the following statements:

1. Exports of coal from Australia to Japan;
2. Import of an IBM computer to Australia;
3. Payment of interest on an overseas loan owed by the private sector in Australia;
4. Payment of an age pension to an Australian citizen living in Greece;
5. Purchase of an airline ticket by a resident of Hong Kong from Qantas for travel from Hong Kong to Singapore;

6. Purchase of oil by a Liberian registered ship in an Australian port.

Which category would these be classified as, namely (G) goods, (S) services, (I) income, (T) transfers. (Enter your answer as either G, S, I or T. Note: Some categories may not appear, others may appear more than once.)"

This question is related to learning objective a. i.e. "identifying the empirical counterpart of concepts understood in verbal terms."

True/False Question:
"Given the following hypothetical data on exchange rates in respect of the Australian foreign exchange market:

	Yen/$A	Brazilian Cruzerio/$A
June 1985	310	3560
June 1986	270	4920

The Japanese yen has depreciated against the $A?"

This question relates to learning objective b. i.e. "drawing logical inferences from verbal statements or from simple data (either hypothetical or real)."

Calculation Question:
"Assume you are a portfolio manager with $A ### to place in the short term money market and that the spot Dutch Guilder/$A rate is #.## and that money market rates in Amsterdam and Brisbane are ##% and ##% p.a. respectively for a six month term; what six month forward exchange rate would leave you indifferent between placing funds in Amsterdam or Brisbane? (Express your answer to two decimal places e.g. X.XX)"

[Note: The numbers represented by ### are randomised variables so that each calculation is unique.]

This question illustrates the proposition known in economics as "The Covered Interest Parity Theory of Foreign Exchange" and is important for understanding the relationship between money markets and foreign exchange markets. The calculation is fundamental to understanding the concepts involved.

4. IMPLEMENTATION OF THE PROJECT

The project used a VAX computer and the software supplied commercially by CBTS with a testbank specially written by Jon Stanford. The course material was divided into three modules:

- International Trade and the Balance of Payments
- Foreign Exchange
- The Monetary System and Monetary Policy.

A further subdivision of the modules may have been desirable but the limitations of the time available for the project (the final seven weeks of Second Semester) and the large number of students made this impracticable.

Students were required to take three randomly generated tests; one for each module. Each test consisted of approximately 15 questions being a mixture of true/false; multiple choice; matching and calculation with each type of question carrying a different weighting. The mastery level was set as 75% for the first test, 80% for the second test and 85% for the third test. Students were allowed a maximum of three attempts at each test; each test had different randomly drawn questions.

A short formal introduction into the use of the CML system was given to each of the three student groups before they were permitted to access the system.

Student names and identifiers (the first six digits of their student number) were loaded onto the VAX from student master files held on the University's IBM mainframe avoiding the need to enter such data manually.

On a terminal students were able to:

- draw a test
- have test marked
- examine the learning objectives
- set/change a password
- send a message to the lecturer
- look at their records and status.

Upon request from a student the computer generated a test which was then queued (within the computer) for printing at one of the two teletype printers and logged the student off the system. If students took one of the other options they remained on the system for longer but still only for a relatively short period.

The system had 14 VDU terminals and this proved to be generally satisfactory for the 600 students who used the system; there were queues at peak times especially lunch time but these were no longer, and nearly always shorter, than those in the student Refectory. The Computer Room was open 8am-10pm, Monday to Friday and 9am-5pm Saturday and Sunday.

Students prepared answers for the test away from the computer; some answers required consultation with the text books, lecture notes, handouts and some required calculations to be performed. When ready to answer the test, students logged on to the system and gave their answers when prompted by the computer which provided opportunities to review and change answers. When the answering process was completed the computer marked the test, informed the student of the percentage achieved and printed out the correct answers to incorrectly answered questions. If students obtained the required percentage they were able to draw the next test; if not, they could draw another test on the same module (immediately).

The lecturer was able to gain access to different menus on the CML system in order to:

(i) monitor student progress from reports supplied by the CML system on demand,
(ii) respond to individual messages from students,
(iii) send messages to the entire class,
(iv) change student marks where some error or problem had occurred,
(v) obtain student passwords where students had forgotten them, and were thus denied access to the CML system,
(vi) check progressively on the questions issued from the test bank, and
(vii) check the response rates to questions issued.

These functions are very important in enabling the lecturer to manage the course. In 1986 the hardware configuration was not entirely adequate to allow this to be done in an optimal manner. In particular, all terminals were located in the area to which students had access. This posed problems with security and confidentiality and meant that the lecturer was interrupted frequently,by students. The apporopriate solution to these problems is to have a terminal, reserved exclusively for lecturer use, in another private area. The best solution is to have a terminal located in the lecturer's office.

From the outset of the project, students experienced problems related to system unfamiliarity and system constraints. As these were identified they were quickly rectified (wherever possible). It is fair to say that the CML approach required substantial commitment of time and energy on the part of the three staff involved (Stanford, Cook & Wood) without which success might not have been achieved.

5. STUDENT QUESTIONNAIRE

5.1 The Student Questionnaire

Students were asked to complete a Questionnaire to enable an assessment of their response to CML, independent of their performance in the end-of-year examination. The Questionnaire was given to students in tutorial sessions a week before the end-of-year examination. A number of the questions asked on the Questionnaire were open-ended; the individual student "feelings" towards the CML approach were sought, rather than by gauging student reaction using selection of a value on a point scale. A full list of student responses and comments to the Questionnaire is contained in Appendix B.

The Student Questionnaire is outlined below, including a summary of the number of responses to each question.

****

EC110 STUDENT QUESTIONNAIRE ON THE COMPUTER MANAGED LEARNING SYSTEM (CML)

INTRODUCTION

The CML system introduced to EC110 in Second Semester is designed to assist students by providing greater opportunities for self-paced testing and for immediate feedback of results.

As well the CML system offers the lecturer considerable advantages in managing and supervising a large course and in analysing the course objectives and questionbank. Since this is the first time the CML system has been used in the University of Queensland, it is important to have responses from you about how you regard the system. I would be grateful if you would complete the following questionnaire. Unless you wish otherwise, your response will be anonymous.

Thank you,

Jon Stanford

* * * * * * *

QUESTION 1 BEFORE USING THE CML SYSTEM DID YOU HAVE ANY PREVIOUS EXPERIENCE WITH COMPUTERS?

No = 94
Yes = 392

If yes*

at university = 205
at business = 61
at home = 108
at school = 300
other = 8

(* many students made more than one selection)

QUESTION 2 WHAT DID YOU THINK ABOUT COMPUTER BASED (IMMEDIATELY AVAILABLE) TESTING?

430 comments were given; these comments are listed in Appendix B.

QUESTION 3 WHAT DID YOU THINK WAS THE GREATEST ADVANTAGE OF THE CML SYSTEM?

439 comments were given; these comments are listed in Appendix B.

QUESTION 4 DID YOU EXPERIENCE ANY FRUSTRATIONS WITH THE CML SYSTEM?

No Yes (If Yes please indicate)

No = 265
Yes = 189

The 189 comments given are listed in Appendix B.

QUESTION 5 WOULD YOU HAVE LIKED THE CML SYSTEM IN THE ENTIRE EC110 COURSE?

No = 43
Yes = 446

QUESTION 6 WOULD YOU LIKE TO SEE THE CML SYSTEM IN OTHER COURSES?

No = 63
Yes = 409

QUESTION 7 DO YOU HAVE ANY OTHER COMMENTS ABOUT YOUR EXPERIENCE WITH THE CML SYSTEM?

No = 309
Yes = 145

The 145 comments given are listed in Appendix B.

QUESTION 8 WHAT IS YOUR VERDICT ON THE CML SYSTEM? SHOULD THE DEPARTMENT PROCEED WITH THIS SYSTEM?

No = 17
Yes = 465

QUESTION 9 WOULD YOU LIKE TO HAVE MORE CONTROL OVER THE CML SYSTEM (E.G. DRAWING TESTS WHENEVER YOU LIKED; PROCEEDING THROUGH THE COURSE AS FAST AS YOU LIKED)?

No = 83
Yes = 352

QUESTION 10 WOULD YOU PLEASE TELL ME SOMETHING ABOUT YOURSELF?

DEGREE ENROLLED FOR:

B.Ec (incl. B.Ec/Law) = 89
B.Comm. (incl. B.Comm/Law) = 238
B.A. (or other) = 126

YEAR OF FIRST ENROLMENT AT THE UNVERSITY OF QUEENSLAND.

1986 = 325
1985 = 47
1984 = 18
1983 = 13
1982 = 6
1981 = 6
1980 = 5
OTHER = 25

GENDER:

FEMALE = 190
MALE = 260

ENROLMENT:

FULL-TIME = 399
PART-TIME = 55

QUESTION 11 ANY OTHER COMMENTS?

No = 327
Yes = 126

The 126 comments given are listed in Appendix B.

(Note: The number of answers for all questions do not fully tally, as some students did not answer all questions.)

****

5.2 Summary of Student Comments to Questionnaire

QUESTION 1 Before using the CML system did you have any previous experience with computers?

80.7% of students (392 out of 486) indicated some previous computer experience. It should be noted that CML does not require any programming or data entry (other than answers to test questions) by students. Student use of a CML system is basically to draw tests, enter answers for marking and receive feedback on performance.

A number of students who did not have previous computer experience indicated in Questions 3, 4 and 7 of the questionnaire that CML had been a good introduction to computers and that they had found the system relatively easy to use - even though they may have had misgivings initially.

QUESTION 2 What did you think about computer based (immediately available) testing?

Of the 430 students who made comment to this question, 90.7% (390) of the responses could be grouped as being positive. Comments covered a range of issues, including that computer based testing:- was fair, assisted in understanding and learning of subject, makes students study to keep up with lecture material, provides immediate feedback, was good for revision, was an effective assessment approach, provided greater opportunity to learn from mistakes, reinforces significance of lecture material, was interesting and motivational, was very practical, gave time to work through and research for answers to test questions, supported learner control (self-pacing), and was an effective way to learn.

3.7% (16 comments) of students were negative about computer based testing, these included that it was impersonalised, inconvenient or that the student just did not like it.

The remaining student comments, 5.6% (24 comments), were neutral, either it was OK, satisfactory, etc. or that although it was useful there was some aspect that could be improved, such as:- adequacy of printers*, operation of software, and access for part-time students.(* this issue is discussed further in question 4)

QUESTION 3 What did you think was the greatest advantage of the CML system?

439 students gave a response to this question. Many students made comment that covered more than one issue, where this occurred the student comment was assigned to one particular comment type.

30.1% (132 comments) of students thought that CML was:- flexible, convenient, easy to use, efficient and accurate, readily available and immediate in its marking and feedback.

28.5% (125 comments) of students commented on learning benefits. They noted that they:- found out their weaknesses, had time to do the tests properly and research for answers, were forced to keep up in the subject, had a better chance of passing the subject, had increased motivation and that CML was an active learning process which reduced student stress and that tests provided a useful guide in studying the subject.

21.6% (95 students) made comments related to aspects of learner control; that they could manage their time on this subject (EC110) and therefore other subjects better, could work through the subject at their own pace, determine themselves when they were best ready to learn and had control over their own workload and deadlines.

Revision was indicated by 6.8% (30 students) to be the greatest advantage; that on completing the tests they had copies of typical questions, with answers, and that CML had provided good preparation for the end-of-year examination.

5.5% (24 students) thought that having up to three attempts at each assignment (i.e. with different questions randomly drawn on each attempt) was helpful as they were then under less stress, could learn more, were able to learn from their mistakes, and better understand the course content.

3.9% (17 students) stated that the CML system was convenient and saved them time. 2.5% (11 students) thought that the CML assignments provided easy marks - as it was difficult to fail the tests, whilst 1.6% (7 comments) of students considered CML enabled them to get better results (including that it was possible with computer marking to get 100%). 0.7% (3 students) highlighted computer experience as the greatest advantage of the CML system.

Of the 439 comments received, only 1.1% (5 comments) of students indicated that they did not like the CML system.

QUESTION 4 Did you experience any frustrations with the CML system?

41.6% (189 out of 454 students) answering this question, indicated that they had experienced frustrations with the CML system.

33% of the students (i.e. 63 of the 189 students) indicating frustration with the CML system, stated printer malfunctions (paper jamming, etc.) and printers running out of paper as their source of frustration. Two old teletype printers (29 characters per second) that did not have buffers were used for the project. If paper supply to the printers ran out, or there were jams in the paper feed, then students in line to have tests (or test summaries) issued lost all or part of their print-outs. Frustration was experienced by these students if they then had to seek supervisor support to re-issue tests or results or reset their status. This was a particular problem for part-time students using the computer facility in evenings or at weekends. As there was no means of providing adequate supplies of printer paper securely, frequent paper supply problems occurred*. Also the speed of the printers** was frustrating to 4.8% (9 of the 189 students), especially if the maximum number of users were on the system at one time and there was back-log of test and test summaries to be issued.
(* This problem was overcome in 1987 by mounting the printers on locked cabinets containing adequate paper supply. ** This problem was overcome in 1987 with the purchase of two high speed (260 characters per second) printers).

14.8% (28 of the 189 students) indicated not understanding the use of the computer or having operation problems with the computer as a frustration. A number of these students considered that the initial introductory explanation - a 20 minute lecture to groups of over 200 at a time - was inadequate and difficult to follow*.
(* This issue was addressed in 1987 by providing a short CML users guide on the operation of the CML system at each computer terminal).

12.1% (23 of the 189 students) expressed failing tests as a frustration for them: these comments included that pass marks were set too high, the perceived inaccuracy of the computer in marking answers, getting answers wrong or just simply failing the tests (and having to do another test).

Inflexibility of the CML software system was a frustration to 11.6% (22 of the 189 students). These comments were aimed mainly at not being able to get another copy of test answers off the computer for themselves, and the answer styles of some of the questions. A further 7.4% (14 of the 189 students) made comment as to the way the CML system had been set-up, particularly that some of the options on the "Student Menu" were not available to students (e.g. Challenge, Study Guide, Review). Too many marks being allocated to the calculation questions was a frustration to a small group of these students and a number indicated the lack of specific feedback on questions answered incorrectly. The CML software permitted the issue of correct answers to students (to incorrectly answered questions) at the conclusion of the marking of tests; however, the CML system did not provide a means of providing feedback statements to students for these incorrectly answered questions. This issue is again raised by students in questions 7 and 11, and was a comment frequently raised by students in informal discussion in the computer room.

6.9% (13 of the 189 students) thought that the wording of some questions was ambiguous or they had had correct answers marked incorrect. This issue is discussed further in section 5.3 of this report, where student misunderstanding of the subject material is identified as the apparent ambiguity. However, some question error did occur; this was mainly caused by the haste with which the CML system had been set up, and because additional questions were continuously being added, resulting in occasional typographical errors in either the questions or their answers. These errors were easily rectified once identified by the students and brought to staff attention.

2.1% (4 of the 189 students) indicated that the next assignment not being available from the computer as quickly as they would have liked (as the questions were still at the data entry stage) to be a frustration, while only 1.6% (3 of the 189) students stated their frustration was the lack of availability of computer terminals.

QUESTION 5 Would you have liked the CML system in the entire EC110 course?

(See Appendix B for details)

QUESTION 6 Would you like to see the CML system in other courses?

87.7% (409 out of 472 students) answered yes to this question.

4 of the students that answered yes, 2 that answered no and a further 8 students that had not answered this question at all, added that they thought it would depend on the nature of the subject, the structure of the course or the number of students enrolled in the subject.

QUESTION 7 Do you have any other comments about your experience with the CML system?

Of the 145 students who commented, 31.0% (45 students) stated that they had enjoyed CML and were supportive of it. Some hoped for more CML as they considered it had helped them with the subject.

9.7% (14 of the 145 students) suggested that more feedback should be provided on the test summary for those questions answered incorrectly (also see question 4 above).

8.3% (12 students) considered that the instructions on how to operate the CML system needed to be improved (also see question 4 above).

Access to further tests for revision/practice were requested by 5.5% (8 of the 145) students, and 4.1% (6 students) indicated that refinement of the CML software was required to support increased learner control.

3.4% (5 of the 145 students) suggested that greater human support was needed in the CML process; 3.4% of students recommended that better printers be used (see question 4 above) whilst a further 3.4% of students thought that CML was a waste of (printer) paper.

2.0% (3 students) made comment that the computer room should be open for longer hours, 13.1% (19 students) provided miscellaneous comments to this question, and 2.0% were negative outright on CML.

QUESTION 8 What is your verdict on the CML system?
Should the Department proceed with this system?

Of the 482 students who answered this question, 96.5% (465 students) said yes, leaving 3.5% (17 students) who answered no.

The authors of this report were optimistic before the pilot study commenced that student acceptance of CML would be favourable; however, they were overwhelmed by the extent of the positive student reaction to the CML approach.

QUESTION 9 Would you like to have more control over the CML system (e.g. drawing tests whenever you liked; proceeding through the course as fast as you liked)?

80.9% (352 out of 435 students) indicated that they would like more control over the CML system compared to 19.1% (83 students) who stated that they did not. This highlights the issue of individual needs, different learning styles, etc. quite strongly. The issue of learner control appears to have generated a great level of discussion in the last two or three years amongst educators, perhaps as a result of the greater use of technology in various forms in the learning process in recent years.

This project provides no specific information on learner control but highlights that this issue warrants further research as it would appear to be a significant issue to students.

QUESTION 10 Would you please tell me something about yourself?

(See Appendix B for details)

QUESTION 11 Any other comments?

126 students provided comment, most of these comments have been covered in previous questions but not necessarily by the same students.

17.5% (22 of the 126 students) stated that CML had helped them greatly,while a further 9.5% (12 students) expressed thanks for its introduction. 14.3% (18 students) indicated that human support was necessary as part of the CML structure, this support being both in the computer room (advice on system use and fixing minor problems) and tutorial.

10.3% (13 students) thought that CML was a better form of assessment and that it assisted their learning; they suggested that CML be used further for assessment on campus. A further 7.1% (9) of students requested that CML be used with other subjects in their course.

10.3% (13 students) stated that they thought the concept of CML was good but suggested some refinement of hardware and software was needed to improve the acceptability of the system.

7.1% (9 students) considered that the assessment aspect could be refined including a greater range of questions, lower passmark, part marks for questions not answered fully correctly, more definite assessment deadlines, etc., and 4.0% (5) students requested greater feedback from the computer for questions incorrectly answered.

2.3% (3 of the 126 student comments) recommended better initial instructions on how to use the CML system (see question 4 above). A further 1.6% (2 students) thought that CML, the way the system was being applied, did not discriminate between student abilities and enabled students to cheat 12.7% (16) of students made comments of a general nature relating to their degree course generally; problems of part-time students etc. Only 3.1% (4 students) made negative comments about CML.

5.3 Discussion of the Student Questionnaire

The response rate to the Questionnaire was high; representing 76 per cent of the nominal enrolment, and 87 per cent of the students who sat for both examination papers at the November 1986 examinations.

Some issues raised by students which require further elaboration are discussed here. These are:

- system problems
- test design and construction problems
- cheating
- formative versus summative testing.

The second surprise from the project (the first being the extremely high level of student support for CML) was the relatively small number of system problems. Most related to printer and paper supply problems; given the demands on the printers (over 3500 tests and 3500 results were printed in six weeks) and the poor quality printers used, the problems were well within acceptable bounds however annoying and frustrating they were to the students concerned. The solution to this problem is simple - buy better quality printers! (This has been done at low cost in 1987 and these problems have been significantly reduced).

The level of problems with the test design and construction was also low; some problems were easily fixed - errors in questions and solutions were eliminated as soon as they became known and some test items were refined in the light of experience; however, the temptation to tinker with the testbank was resisted until the CML testbank file had sufficient data for analysis.

Some students commented that questions were "ambiguous"; this may have been true of some questions but most of the "ambiguous" questions showed that some students were unable to discriminate between finer shades of meaning, closely related concepts and valid and invalid inferences.

A small number of comments related to the possibility of "cheating" because the tests were done away from the terminal without supervision. Since the testing was designed as formative rather than as summative, students were encouraged (at times required) to consult textbooks, notes and references to answer test questions correctly. As well some test items generated spirited (at times heated) debate in small groups of students. We think that such activity is entirely appropriate at a university and consider that it is a desirable feature of the CML system if it encouraged such behaviour.

It is possible under the testing procedures for a student to cheat in the ordinary sense of the term i.e. to obtain answers from another student and use them for their own. However, the system has safeguards against this.

First, each test is unique (calculation questions have been randomised so that even if two students receive the same question the data are different) so that collaboration is made difficult. This is particularly true in the first year of CML when all the questions are new and there is a high level of uncertainty about the correct answer.

Secondly, while there are advantages to cooperation between students, it remains true to say that students are in fact competing for grades so there is an incentive for better students to withhold information.

Thirdly, to cheat in this way requires the cheater to be able to identify other students with superior and correct information and who are willing to release this knowledge; empirically we can say that such abilities to discriminate are rare.

Fourthly, and perhaps more importantly, it should be understood that the CML system and associated computer held records provide an easy means for the lecturer to maintain surveillance of student performance and to identify students whose performance on the CML tests appears to be inconsistent with other test results and student characteristics.

Fifthly, observation of the end-of-year examination results (which were independent of the CML tests) indicate the great value of the CML approach. Clearly, CML cheating, if any did in fact occur, when considered in this context is a non-issue.

6. EVALUATION OF CML

The evaluation of CML was carried out by assessment of:

6.1 The Responses to the Student Questionnaire
6.2 The Results of the End-of-Year Examination
6.3 The Cost of CML Relative to the Traditional Approach.

6.1 The Responses to the Student Questionnaire

Response to the Student Questionnaire was made by over 75 per cent of the nominal student enrolment and comprised the following by degree enrolment:

	Per Cent
B Econ (incl. B Econ/LLB)	20
B Com (incl. B Com/LLB)	53
B A and other degrees	28

which is the proportional breakdown of the total enrolment.

Questions 5, 6 and 8 noted below highlight the extent of the student response to CML.

In answer to Question 5: "Would you like to see the CML system in the entire EC110 course?" 91 per cent of respondents said yes; in answer to Question 6: "Would you like to see the CML system in other courses?" 87 per cent of respondents said yes; while in answer to Question 8: "What is your verdict on the CML system? Should the Department proceed with this system?" 96 per cent of respondents said yes.

An observation is appropriate here; from student comments to the Questionnaire, and from general student sentiment, it was apparent that student dissatisfaction with the weekly quizzes and the "mass tutorials" was high. Students, generally and in our opinion, quite justifiably, found the lag in receiving results from the weekly quizzes (up to 6-7 weeks) too long and of no use in assisting their learning. It should be noted that students received only a numerical grade for the quizzes; they were given no feedback as to the correctness of their answers, or about their possible weaknesses. The weekly quizzes were summative evaluation, which was not appropriate given that there was a final summative evaluation through the final end-of-year examination. The introduction of CML was designed, in part, to improve the situation in EC110, and in hindsight it is clear that students were receptive to the introduction of a system which gave them and their learning needs a high priority.

From this evidence we conclude that the student satisfaction with the CML system was at a high level and that student response to the system was positive.

From the general discussion of the responses to the Student Questionnaire we conclude that generally the CML system constituted a positive learning experience for most students.

6.2 The Results of the End-of-Year Examination

The unadjusted and unscaled results from the unseen end-of-year examinations are shown in Table 3 below; the examination papers were set by each academic responsible for lecturing each segment of the course but were not necessarily marked by that person; in fact most of the papers were marked by other members of the Department.

TABLE 3. RESULTS END-OF-YEAR EXAMINATION IN EC110 INTRODUCTORY ECONOMICS, 1986. (& 1985)

		Percentage of Students			
		First Paper	Second Paper		(1985)
Percentage	Grade		Part A	Part B*	(2nd Paper)
0-40	1	11.5	47.6	14.8	53.8
41-49	2/3	20.4	10.1	4.2	
50-64	4	43.3	21.3	19.3	26.4
65-74	5	17.6	10.1	18.5	12.2
75-84	6	6.7	8.5	24.4	5.2
85+	7	0.7	2.4	18.8	2.3

* Segment of the course to which the CML System applied.

Grades in the University of Queensland are awarded on a seven point numerical scale from one through seven with a grade of four being a Pass and grades of five, six and seven being superior passes in ascending order; a grade of three (usually awarded to papers with a mark just below 50 per cent) is a non-qualifying pass while grades of two and one are unambiguously failures.

The examining conventions at the University of Queensland as expressed in the guidelines issued by the then Professorial Board (now the Academic Board) are that grades should approximate the percentages indicated in column one of Table 3. Final grades for the course are determined by results of progressive assessment as well as end-of-year examinations.

In order to assess the results in Table 3 it is necessary to consider the 'a priori' expectations one would hold in respect of the three components of the end-of-year examination. Since the segment of the course to which the CML system applied, and to which the Second Paper Part B results apply was the last segment of the course, and because some knowledge of the segment covered by Part A is considered necessary as a pre-requisite for Part B, our 'a priori' expectations are that results in Part B would be no better than in Part A or in the First Paper and may be significantly worse.

In the light of this expectation our interpretation of the results in Part B which are statistically significantly different from those in Part A and the First Paper is as follows:

1. The results in Part B are consistent with previous experience in Keller Plan and PSI courses;

2. The results in Part B discriminate clearly between student passing and failing grades which we regard as a desirable feature in its own right;
3. The results of Part B may reflect a Hawthorne effect due to strong student acceptance of CML as disclosed in the results of the Student Questionnaire so that the superior results in Part B may be due in part to inducing students to devote more time and effort to the work of Part B.

Given these qualifications and other matters which cannot be tested, we would conclude that the results in Part B are consistent with the view that student performance in Part B of the course has been improved through implementation of CML.

Lastly, 1985 results, as shown in Table 3, indicate that poor student performance in end-of-year exams is not a new phenomenon. Informal discussions with staff in other academic departments indicates that such student performance is not unusual in large first-year courses. The introduction of CML has clearly altered this situation in the Introductory Economics course.

6.3 The Cost of CML Relative to the Traditional Approach

The costs of CML fall into the following categories:

i. Hardware costs
ii. Software costs
iii. Costs of establishing the testbank and the operational procedures
iv. Cost of consumables.

i. Hardware costs

Under the University of Queensland's resource allocation and accounting procedures, the costs, both initial capital and running, are not allocated to operational unit budgets and the hardware is treated as a common resource so it is not possible to know how much of the hardware cost is properly allocable to this CML project. For the purposes of making cost comparisons we assume that the rental costs of the VAX for the period of the project were $25 000.

ii. Software costs

The all-up cost of the CML package, supplied by CBTS in 1985, was $18 000.

iii. Costs of establishing the testbank and the operational procedures

Major costs of the project were the cost of establishing the testbank, which Jon Stanford estimates as taking at least three weeks full-time work, and the costs of setting up the project which took two months of Howard Cook's time. Ensuring the project worked meant that both authors had to forget any ideas of 9 to 5 days and during the period CML was used by students both worked weekends and most nights of the week.

iv. Cost of consumables

Costs for consumable supplies to keep the project running (paper and ribbons) were trivial. Total costs were less than $500 and amounted to an average cost per test generated of approximately 11 cents. This cost also included the processes of marking the test, issuing results to the student, keeping records and providing data for analysis of student and question bank performance.

Our evaluation of CML suggests that it is cost effective; if we allocate all costs, except for the time of the authors in developing the project, to the first year of the project we estimate the average cost per student is approximately $70. If the cost of the software is amortised over three years the average cost falls to $50; if the cost of the hardware is amortised over the expected life of the hardware the average cost falls to approximately $30. These costs have to be compared with the marginal funding available to the Department in respect of each additional student; in 1985 this was $2500 per student or over $600 if allocated by the straight line method to EC110.

That CML is cost-effective is emphasised when it is remembered that despite relatively high first year costs, second and subsequent year costs would be much less. In addition, in later years, CML would become a routine activity so that it would be maintained and expanded with less skilled and dedicated staff than was required to establish it in the first place. In 1987 CML is being used in three first-year courses and one third-year course; the costs of expansion in this way are much less than the establishment costs.

7. OTHER ISSUES

CML enables more students to be taught effectively with given resources; it enables a saving of resources used in the repetitive areas of marking simple tests and in recording results and other data; these resources can be more effectively used in other areas of course management and design. CML also enables students to gain more control over the pace at which they progress through the course; if this feature of CML were expanded we estimate that a significant proportion of students could complete the course requirements in less than a semester.

In order for these benefits of CML to be captured completely, the University needs to change certain features of its organisation. One horror story will suffice to illustrate this point. The complete student records in EC110 were maintained on computer in 1986; the University administration was offered the lists in any one or all of the following ways:

i. in hardcopy printed by computer in any format;
ii. on floppy disc;
iii. on file on the University mainframe transferred via Kermit from our floppy or from the VAX.

We were amazed to find that the only format they would accept was their forms completed by hand!

One of the implications of introducing CML into a course is the increased workload for the lecturer in developing the test bank and time involved in getting the CML system operating as required. Although the initial work commitment would be greater than without CML, once CML was up and running the lecturer would be relieved from many clerical/administrative duties and the workload in this context could fall well below its previous level.

However, it is recognised that as a result of greater student activity in a CML environment, the lecturer would likely face increased tutorial effort from students on an individual basis. This would provide an opportunity in many situations to provide rostered tutorial support by tutors, i.e. deploying staff resources effectively by passing the activity down to the lowest possible level.

Where the academic is not able to call on the tutorial assistance of other staff, then this additional workload would have to be met by the lecturer. This then results in a changed role for the academic. Their time is spent more on providing assistance to learners experiencing difficulties and on managing the learning environment rather than providing delivery of lower level information.

It is considered that the job satisfaction associated with a CML environment would be higher than at present, due to having students with greater motivation, and releasing the lecturer to concentrate on higher level tasks.

Our experience with CML is that student satisfaction with their studies was increased as a result of using CML. The issues of increased student performance, increased student confidence and increased student capacity to learn should not be overlooked.

The application of CML could have a multiplying effect where good effects build on other good effects. The benefits to society at large of a more effective and productive education system are likely to be enormous.

CML offers the potential to increase student numbers at a rate greater than the rate at which resources would need to be increased. This is a significant cost-effective issue. The Department of Economics increased its student intake in 1987, and it appears that the student intake will be further increased for 1988. It is considered that these increased student numbers can more easily be accommodated and supported in a CML environment than without.

8. CONCLUSIONS

From the experience of using CML for formative assessment in a large first-year economics course in 1986, we conclude that:

1. CML had improved student performance by as much as 40 per cent on the final examination in 1986. We also note that it significantly reduced the percentage of students who obtained less than 50 per cent in the examination as compared with the results in 1985;
2. Student responses to CML were very favourable;
3. Students found that CML supported their learning; however, many indicated a preference for increased learner control, an aspect requiring further serious investigation;
4. Student motivation in the course increased as a consequence of using CML;
5. The costs of establishing CML, whilst not insignificant, reduce substantially in later years of use, making CML a cost-effective approach;
6. A major cost of establishing CML is related to the need to have highly experienced staff initially; this need reduces over time however;
7. CML improves productivity in teaching a large first-year course in two ways: (i) by allowing academic staff to manage more students with given resources, and (ii) by enabling students to progress through the course more quickly and at a higher level of achievement;
8. Potentially CML, used on an extended scale, could reduce the total time taken to complete a course and thus reduce the time necessary for graduation. In order to achieve this, however, would require organisational and administrative restructuring.
9. The cost of testing using the CML system is very low - amounting to 11 cents per test (including issuing, marking and recording) - which is far less expensive than using traditional methods.
10. The capacity of CML to provide immediate results of tests cannot be duplicated by human means. Tutor marking should be restricted to areas where the human factor is important, i.e. in assessing higher level skills.
11. The CML approach requires on-going human support to ensure that student frustration does not undermine the effectiveness of this approach.

9. FURTHER IMPLEMENTATION OF CML IN 1987

Due in part to the success of the pilot CML project, a number of Department of Economics staff expressed interested in trialling CML in other courses in 1987. In January 1987 Howard Cook was appointed (as CML Consultant) to the Department of Economics to assist academic staff interested in utilising the CML system.

Several lecturers developed testbank materials for assessing students by means of the CML process. Two full-year courses, EC110 and EC134, were supported by CML throughout the year. This included the participation of five academic staff, three for EC110 and two for EC134. Two further courses, EC113 and EC301 - both second semester subjects - had part of their assessment process administered by CML.

EC110 and EC134 both had 13 module assignments for students to complete throughout the year. EC113 had three assignments and EC301 had one assignment for students to complete in the early stages of semester two. The nominal student enrolments for these courses were EC110 690 students, EC134 580 students, EC113 220 students and EC301 140 students.

This resulted (in addition to approx. 260 students using the VAX computer for other software applications for other courses) in almost 1300 students using the VAX for CML self-assessment tests in first semester. In second semester student numbers using CML were over 1600. Although the number of terminals connected to the VAX was increased in early 1987, to over 20, the computer performance was greatly reduced when 10 or more students accessed the computer at a time. For most of the year the number of simultaneous users was kept to approx. 14 for this reason. The problem is considered to be due to the size of the main memory (4 MB); however, this problem is expected to be significantly reduced shortly with the addition of extra main memory (a further 8 MB).

Notwithstanding the above computer limitations, it is estimated that 49 000 CML tests were issued to students in 1987, with a corresponding 49 000 tests being later CML marked. This was done at a cost of $3400 for paper and ribbons, i.e. a cost of 7 cents a test (issuing the test and providing a subsequent results summary). It may be worth noting that most CML tests were several pages long, and many contained over 25 questions of various types, which many students stated took a number of hours to complete.

Almost all students spoken to informally throughout 1987 indicated that CML was providing them with substantial study support, and that they were positive to its continued use.

10. FURTHER POTENTIAL OF CML

The pilot project suggests that there are further areas in which CML could be used and that there are other developments which could increase the effectiveness of CML. These include:

1. CML has a great potential for Resource Based Learning, an approach which is relatively little used in the University of Queensland.
2. Although the pilot project was concerned with a large course, CML has potential to be applied to small courses, particularly those suitable for Resource Based Learning.
3. CML has a role to play in diagnostic testing in order to stream students into tutorial groups and to provide remedial teaching.
4. CML can be used to select students for a "master class"; entry to which is restricted to those students who have completed pre-requisites for the class through CML tests.
5. If an optical scanner were attached to the system, CML could be used for supervised tests and still retain the benefits of computer marking and record keeping; such an application would particularly relevant for large enrolment courses.
6. CML provides the possibility of administering supervised tests for smaller-sized classes on demand, subject to availability of supervision.
7. CML provides the means by which year round teaching could be implemented.
8. At a time when Universities are finding it difficult to maintain the employment of a large number of tutors, CML can provide support to students and free tutors for higher level tasks.
9. If the system of University entry were changed to select in terms of specific achievement, CML could be used to provide the testing facilities.
10. The application of an electronic mail feature in conjunction with the CML approach would provide a further improvement in student support by enabling communication between student and tutor and between students themselves. This feature would be especially valuable in the case of external and part-time students.

11. SUMMARY

Although the increase in student performance in the end-of-year examination has been identified, it is not apparent if other factors need also to be taken into account. For example, if a Hawthorne effect had occurred and students had devoted more time and effort to the CML section of EC110, was this exclusively at the expense of the other non-CML sections of EC110, or would student results in other courses also have been affected? As the pilot implementation of CML was of a short duration (7 weeks) it is unlikely that any significant data would be identifiable for 1986. However, as CML has been introduced on a much larger scale in 1987, and if improved student results again occur in CML courses in 1987, perhaps it would be worth looking at student results in their non-CML courses, to see if there is any indication of lower student achievement for these courses in 1987.

If student performance can be maintained using CML, and as CML provides support to large student numbers, perhaps Australian institutions can significantly increase participation rates in tertiary study, at a cost the community can afford.

It should not be overlooked that CML requires students to take an active learning role, and fosters the taking of responsibility by individuals for their learning needs. These skills are becoming increasingly important as individuals face a continuously changing workplace environment, and where responsibility for self-development (competence) will frequently be left to the individual.

CML not only increased student performance in the end-of-year examination, but many students also made comment in the Student Questionnaire regarding increased learning motivation as a result of using CML. The implications of students being more confident, having lower failure/drop-out rates, having a more positive attitude towards their studies and potentially entering the workforce as better graduates should not be underestimated or undervalued.

Other observations:

- Questions used in the unseen end-of-year examination were not taken from the CML testbank and were not associated with the computer test items.
- It is considered that CML offers great potential to support external students because many full-time and part-time students asked about the possibility of accessing the CML system from their homes via modem, both in 1986 and 1987.
- Students were in fact on the computer system for only a few minutes at a time, firstly to draw a test and later to enter their answers into the system.
- Students requested feedback comments in addition to the correct answer provided by the CML system. The system however did not provide this facility.
- Some students experienced difficulty which perhaps could be attributed to a measure of user-unfriendliness on the part of the software system.

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APPENDIX A

EXAMPLES OF TYPICAL MODULE TESTS

Items:

1. Typical Module 1 Test
2. Typical Module 2 Test
3. Typical Module 3 Test

APPENDIX A. Item 1

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MULTIPLE CHOICE
FOR THE FOLLOWING QUESTIONS PLEASE ANSWER (1-6) OR (A-F)

(3) 1. Question = 1217
In terms of the theory of comparative advantage, the most correct explanation of why bananas are imported into the United States instead of being grown there commercially is that:
- a. bananas cannot be produced in temperate zones
- b. it would take a great deal of effort to produce bananas in the United States
- c. bananas can be produced with less effort in other countries than they can be produced in the United States
- d. United States resources are better employed in producing other commodities, just as the resources of a banana-producing countries are better employed in banana production than they would be in other production
- e. none of these.

(3) 2. Question = 1228
The argument for free trade is essentially the comparative advantage case. So any economic argument for tariffs will be more successful if it can point to some assumption in the comparative advantage analysis that may not be in keeping with the facts of experience. One such assumption is:
- a. that costs of transport are always negligible
- b. that full employment is maintained
- c. that absolute costs, not just comparative costs are important
- d. that each country exports only one good and imports only one good
- e. none of the above because the assumptions are not used in comparative cost analysis.

TRUE OR FALSE
FOR THE FOLLOWING QUESTIONS PLEASE ANSWER T OR F

(1) 3. Question = 1163
A fall in the exchange rate will not affect exporters income because the price of Australial exports are determined in world markets?

(1) 4. Question = 1209
The nations of the world tend to import goods in the production of which they do not have a comparative advantage.

(1) 5. Question = 1110
An economy is said to be more open the more it engages in international trade?

(1) 6. Question = 1126
In a small open economy the price in foreign currency terms paid for imports is determined exogenously?

(1) 7. Question = 1314
The Balance of Payments does not include one-sided transactions such as those which are gifts.

(1) 8. Question = 1309
Imports are recorded in the Balance of Payments as a debit because this is an increase in assets for the home country.

(1) 9. Question = 1308
Exports are recorded in the Balance of Payments as a credit because this represents a loss of assets to the home country.

(1) 10. Question = 1426
A current account deficit in the balance of payments means that Australia receives more goods and services from abroad than it provides to abroad.

(1) 11. Question = 1501
Repayment of overseas loans by the private sector is included in the Capital Account of the Balance of Payments.

(1) 12. Question = 1502
Payment of interest on overseas loans by the government is included in the Capital Account of the Balance of Payments.

(1) 13. Question = 1509
Raising a loan in the USA capital market by an Australian firm trading in the USA is not included in the capital account of the balance of payments because the money does not leave the USA.

(1) 14. Question = 1610
Reduced demand for imports in Australia will lead to a fall in the price of imports?

COMPLETION / SPELLING
FOR THE FOLLOWING QUESTIONS PLEASE READ CAREFULLY AND
RESPOND AS DIRECTED

(5) 15. Question = 1412
Classify the following transactions:
(1) Expenditure in Paris of Australian Embassy staff
(2) Migrant's remittances from Australia
(3) Royalities earned by the Australian film "Crocadile Dundee" in the U.S.A.
(4) Repayment of a SHORT TERM loan from a U.S.A. bank
(5) Shipment of video cassette recorders from Japan to Australia.
in relation to the current account of the balance of payment in one of five ways:
(A) Goods (B) Services (C) Income (D) Transfers (E) Not in current account. (Enter the letters A-E as your answer.)

APPENDIX A. Item 1

PROBLEM SOLVING
FOR THE FOLLOWING QUESTIONS PLEASE READ CAREFULLY
AND RESPOND AS DIRECTED

(15) 16. Question = 1616

Consider the following hypothetical data (all $M): Exports 1360, Imports 1140, Expenditure by overseas tourists in Australia 290, Freight, insurance and other costs paid by exporters to foreign companies 310, Migrants remittances to Australia 270, Australian famine relief abroad 280, New foreign investment in Australia 340, and Australian lending abroad 530.

Calculate:
(i) The balance on merchandise trade
(ii) The balance on current account
(iii) The balance on capital account.
(Express your answers in $M)

(15) 17. Question = 1617

Consider the following hypothetical data (all $M): Exports 1210, Imports 1090, Expenditure by overseas tourists in Australia 240, Freight, insurance and other costs paid by exporters to foreign companies 205, Migrants remittances to Australia 250, Australian famine relief abroad 205, New foreign investment in Australia 460, and Australian lending abroad 250.

Calculate:
(i) The net services
(ii) The net transfers
(iii) The balance on current account.
(Express your answers in $M)

(6) 18. Question = 1435

From the following hypothetical data about the Australian economy (all $M) :

(a) Interest received by Australian residents from overseas 600
(b) Repayment of overseas loans by the Australian government 2800
(c) Interest paid by Australian companies on overseas loans 1000
(d) Repayment of overseas loans by Australian banks 4300
(e) Export of goods from Australia 6500
(f) Expenditure by overseas tourists in Australia 1900
(g) Import of goods to Australia 3000
(h) Purchase of transport services from overseas firms by Australians 5000
(i) Migrants remittances from Australia to overseas 1700
(j) Payment of pensions by European governments to persons resident in Australia 600;

Calculate:

(1) Net services
(2) The balance on goods and services.
(Express your answers in $M)

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TRUE OR FALSE
FOR THE FOLLOWING QUESTIONS PLEASE ANSWER T OR F

(1) 1: Question = -2112
A "short position" in foreign exchange describes the circumstances in which banks hold only short term foreign securities.

(1) 2. Question = -2103
The term "position" in foreign exchange describes the limit to which a dealer may hold foreign exchange.

(1) 3. Question = -2135
In the Australian foreign exchange market a quote of $A1.542 buys one $US is quote expressed in "European" terms.

(1) 4. Question = -2214
Given the following hypothetical data on exchange rates in respect of the Australian foreign exchange market:

	Yen/$A	Brazilian Cruzerio/$A
June 1985	310	3560
June 1986	270	4920

The Brazilian Cruzerio has appreciated against the Yen?

(1) 5. Question = -2217
The Law of One Price states that any commodity will tend to sell for the same price throughout the world.

(1) 6. Question = -2207
Given the following hypothetical data on exchange rates in respect of the Australian foreign exchange market:

	Yen/$A	Brazilian Cruzerio/$A
June 1985	310	3560
June 1986	270	4920

The $A has depreciated against the Yen?

PROBLEM SOLVING
FOR THE FOLLOWING QUESTIONS PLEASE READ CAREFULLY
AND RESPOND AS DIRECTED

(10) 7. Question = -2304
Suppose that the $A spot rate is US$ .6000 and that the short term money market rates in Australia are 10% p.a. while in New York they are 12% p.a.
If the forward exchange rate is US$ .6360/$A today, calculate the profit or loss (to the nearest $A 1000) of placing $A 100,000 in the New York money market for six months rather than in the Australian money market
(Indicate a profit by a "+" or a loss by a "-")

(10) 8. Question = -2308
to place in the
Assume you are a portfolio manager with $A 150000
short term money market and that the spot Dutch Guilders/$A rate is
3.00 and that money market rates in Amsterdam and Brisbane are 8%
and 14% p.a. respectively for a six month term; what six month
forward exchange rate would leave you indifferent between placing
funds in Amsterdam or Brisbane?
(Express your answer to two decimal places e.g. X.XX)

(10) 9. Question = -2303
Suppose that the $A spot rate is US$ .7000 and that money market
rates for a six month term are 20% p.a. in Australia and 5% p.a.
in New York. Suppose also that the forward exchange rate for six
months is US$ .6500.
If you have $100,000 what is the profit (to the nearest $100)
of placing your funds in New York for six months and returning
them to Australia rather than leaving them in Australia for the
six months?

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APPENDIX A, Item 3

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MULTIPLE CHOICE
FOR THE FOLLOWING QUESTIONS PLEASE ANSWER (1-6) OR (A-F)

(3) 1. The major single component of Broad Money is:
- (a) Currency;
- (b) Non-bank financial institutions borrowing from non financial private sector;
- (c) Trading bank deposits;
- (d) Savings bank deposits;
- (e) the Money Base.

(3) 2. The major single component of the Money Supply, M3, is:
- (a) Currency;
- (b) Trading Bank Current Deposits;
- (c) Trading Bank Fixed Deposits;
- (d) Trading Bank Certificates of Deposits;
- (e) Savings Bank Deposits.

(3) 3. If the Reserve Bank of Australia wishes to conduct a TIGHT MONEY POLICY it will :
- (a) require the trading banks to increase the rate of interest they charge on loans;
- (b) reduce the deficit on the capital account of the balance of payments;
- (c) tell the trading banks to increase the rate of interest on their deposits;
- (d) sell bonds to the non bank private sector;
- (e) buy bonds from the non bank private sector;
- (f) tell the trading banks to lend only for productive purposes.

TRUE OR FALSE
FOR THE FOLLOWING QUESTIONS PLEASE ANSWER T OR F

(1) 4. An increase in demand for Australian exports will increase Aggregate Supply in Australia?

(1) 5. The total demand for money is a function of the rate of interest and national income.

(1) 6. The total demand for money is a function of national income alone.

(1) 7. The Prime Assets Ratio (PAR) replaces neither the Liquid Assets and Government Securities (LGS) Ratio nor the Statutory Reserve Deposit (SRD) Ratio?

(1) 8. A reduction in the money supply will leave the aggregate demand curve unchanged.

PROBLEM SOLVING
FOR THE FOLLOWING QUESTIONS PLEASE READ CAREFULLY
AND RESPOND AS DIRECTED

(15) 9. Consider the following hypothetical data (expressed in $M) in relation to the Australian economy:

1. Notes and coin on issue to private sector 150
2. Notes and coin held by banks 20
3. Trading bank deposits with the Reserve Bank 170
4. Other Reserve Bank liabilities to the non-bank private sector 200
5. Trading banks current deposits 1000
6. Trading banks fixed deposits 2200
7. Trading banks certificate of deposits 4500
8. Savings bank 'pass book' deposits 1650
9. Savings bank 'savings/investment' deposits 3500
10. Net borrowings by non-bank financial institutions from the non-bank private sector 3550 ;

Calculate:
(i) The Money Base
(ii) M3
(iii) Broad Money.

(10) 10. Consider the following hypothetical data (expressed in $M) in relation to the Australian economy:

1. Notes and coin on issue to non bank private sector 150
2. Trading bank deposits with the Reserve Bank 150
3. Other Reserve Bank liabilities to the non-bank private sector 225
4. Trading banks current deposits 1500
5. Trading banks fixed deposits 2000
6. Trading banks certificate of deposits 4200
7. Savings bank 'pass book' deposits 2250
8. Savings bank 'savings/investment' deposits 2500
9. Net borrowings by non-bank financial institutions from the non-finance private sector 3850 ;

Calculate:
(i) M1
(ii) Broad Money.

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APPENDIX B

STUDENT RESPONSES TO STUDENT QUESTIONNAIRE

(Although it is not usual to include detailed research data in a report of this type, it was considered that some readers of the report would be interested in the actual student comments - particularly as a number of questions were deliberately aimed at seeking individual "feelings" towards the CML approach)

APPENDIX B

EC110 QUESTIONNAIRE ON THE COMPUTER MANAGED LEARNING SYSTEM (CML)

INTRODUCTION

The CML system introduced to EC110 in Second Semester is designed to assist students by providing greater opportunities for self-paced testing and for immediate feedback of results.

As well the CML offers the lecturer considerable advantages in managing and supervising a large course and in analysing the course objectives and the testbank. Since this is the first time the CML System has been used in the University of Queensland, it is important to have responses from you about how you regard the system. I would be grateful if you would complete the following questionnaire. Unless you wish otherwise, your response will be anonymous.

Thank you.

Jon Stanford

APPENDIX B

RESULTS

(Note: The number of answers for all questions do not fully tally, as some students did not answer all questions.)

QUESTION 1

Before using the CML System did you have any previous experience with computers?

No = 94
Yes = 392

If YES*

at university = 205
at business = 61
at home = 108
at school = 300
other = 8

(* Many students indicated more than one selection.)

QUESTION 2

What did you think about computer based (immediately available) testing?

(where the same answer was provided by more than one student the number of such comments is indicated by ( )).

Good. (75)

Very good. (26)

Excellent. (14)

OK. (10)

Good. Better than the weekly (tutor marked) tests. (6)

It was a better way of testing than weekly tests. (3)

Very helpful. (3)

Useful. (2)

It was alright. (2)

Satisfactory. (2)

Convenient. (2)

It is better than doing tests on the spot. (2)

I thought it was beneficial because you could do it at your own pace. (2)

Efficient. (2)

Great. (2)

I liked it.

Good - its gives you feedback.

It works.

Excellent - provided good examination preparation.

It's fun.

Very effective - very useful.

I thought it would be good.

A good idea for a large course like this.

Inconvenient - don't like progressive assessment.

Enjoyed it immensely. Found it to be an asset to the course and found it helped to get a better grasp of what we were studying.

A fair, more efficient way of learning than previous methods (e.g. 500 word essays etc.).

Thought it was great. Very helpful to assess how much I knew and how much of the work I understood.

Much better than the original form of testing (i.e. that used in first semester). However, more explanation for answers is still required if they are to teach anything.

Very handy - allows you time to study the questions and you get told what the answer is (if you answer incorrectly).

Questions were a bit ambiguous - hard to answer yes or no.

Helped understand the work, greatly enhanced the material given in lectures. We could immediately see what was wrong at the relevant time instead of 6 weeks or more later (as with weekly tests).

Good idea, but the questions were too ambiguous and you can't argue with a computer.

Quite good - much better than tests conducted in lectures - more opportunity to gain better results.

At first had worries about it.

Good idea - should be given a higher assessment weighting.

An excellent idea and very helpful especially considering we don't have tutorials. If only it had been introduced earlier.

An excellent way to relieve the teacher of continuous questions concerning example questions. Course requirements were more easily identifiable.

It was beneficial as it tested your knowledge at your own pace.

The concept is excellent, but more printers could be made available.

A very useful way to learn the important areas in macroeconomics.

Fair - a lot of foul ups with the printers losing tests and no supervisor to sort mess out left a hatred of the damn things when they didn't work.

It is a good idea - it can be used by us to guage how well we are doing and what we are doing wrong i.e. feedback.

It's OK, it helps you understand the subjects practical problems.

It is very practical and creative.

Very good, it offers another dimension to lectures and essays, one which you can explore at nearly your own pace, and one which you are rewarded for time spent learning.

The immediate response doesn't make that much difference to my feeling on the assignments - no room for half marks.

Great; helps me to understand the subject more completely.

It gave a better incentive to keep up with the lectures. It was more rewarding being able to get marks back straight away. This lets you know if you are working hard enough.

Interesting - breakaway from the usual writing-up of assignments.

Very helpful, particularly with regard to revision.

Very useful; a good study aid and motivation for study and reading.

I thought it was a good idea as the computer tests were of a more difficult standard than the class set exams - hence it was more challenging, better for learning the work.

Good, however there's nothing preventing someone else from doing your test questions and then you go and put answers in on the computer.

Advantageous to (be able to) look at the notes. Positive innovation.

It is a very effective way to learn, and a good way to ensure study is carried out throughout the term (semester) rather than just at the end.

I felt the testing was advantageous.

Good idea, have as much time as possible to read test.

Better than waiting four weeks for tutors to mark the other ones (weekly tests).

It is a good way of making sure you can do the work required for the course.

Really good - could do it whenever it suited you; gave you a good idea of what you knew and what you didn't.

Good - positive reinforcement of lecture material.

Interesting, provided a break from routine.

OK. Should be more available though.

A good idea. Being able to work at your own pace makes organising the many assignments I had due a lot easier.

Very good. Beats essays hands down.

Good - gave me an opportunity to work with a computer, as I have not done so previously.

APPENDIX B

Very helpful for learning - having the corrections and the reasons is the best way to learn.

Good, when you worked out how to operate the computer.

Excellent. Learned a great deal more by researching for the answers.

Very good. Access was easy and was a good way to learn the appropriate topics.

It was easily operated and convenient in the way you could do it in your own time.

I thought it was a very good idea as it gave me some understanding of what types of questions could be asked. However, some of the answers were inaccurate.

I liked it as it provided us with the questions and gave us time to answer them; unlike the Friday tests where we never saw the question sheets again.

Very good - I found it helpful in understanding the course.

An excellent idea. The opportunity to take the tests home to use as a guideline while studying the work makes the task a lot easier. Also, getting immediate feedback is great because the work is still fresh in our minds.

It's very handy and efficient.

It aided greatly in the understanding of the course objectives and material for this section (of EC110).

It was a good idea; its various problems can be overcome - such as poor wording.

Different - I was interested in it from the view of curiosity - plus I learnt a great deal.

Was very convenient and a good way to get to know the work.

At least we were able to find out if we correctly answered questions or at least what were the correct answers, unlike the microeconomics section in 1st semester.

It is about time there is some feedback on the testing we are doing in order to help us to improve, and by receiving this immediately there is no "lag".

You could research the questions you didn't know immediately, unlike the 15 minute tests.

It was a good way of testing your understanding of the work covered to date.

It is a convenient method for the students to be able to do tests whenever they liked.

I think this method of assessment is excellent. It gave me the opportunity to view a multitude of a variety of questions.

Alright once I knew what was happening, but the entire introduction was vague and I still have no idea how my progress in computer based testing will effect my results.

Did not like it at all.

Very average.

Impersonalised; efficient means of assessing, very poor for teaching.

Good, as we can prepare for it at leisure.

Good, because you can draw a test (from the computer) at any time.

Very interesting.

I thought it was better than class tests - also gave people a chance to become familiar with computers.

Fantastic.

I liked it - gives you a chance to find the answers, instead of random learning.

A very good idea, because it forces you to learn, whereby otherwise you would have waited until Swat Vac.

Better than doing tests on the spot.

Good - enables understanding of concepts - gives taste of testing guidelines (end of year exam).

Good for revision.

Very good in testing ones ability - very useful to see what standard is required before sitting for exam.

It was an appropriate method of testing students and I believe it (CML system) will be very successful.

Good idea, allowed you to work at your own pace.

Very good, but too easy for cheating.

Very good; it would help if the computer gave an explanation as to why incorrect answers where wrong.

Good, because we can revise on the test printouts - also, not pressurised.

I thought that people who didn't know much about computers were very disadvantaged despite the instructions given.

Advantageous to the motivated student.

I think we should be able to draw more tests and revision programs. The assessment is very accurate and precise. Overall the greatest advantage is speed.

Beneficial.

A help with the study of EC110.

Much better way of assessment than exam conditions.

I don't mind it.

Approve of it.

Helpful.

Quite good. You can be assessed at your pace and if you chose you have time to research the assignments.

Great; maybe if the tutors were quicker at marking tests it wouldn't make much difference.

Efficient, easily accessible.

A good way of testing practical aspects of theory covered in lectures.

Easy and convenient.

Good opportunity for finding out guidelines of the course.

Helpful - makes work easier to understand.

Very good - helped me considerably in understanding course content.

Good way of learning the course objectives.

Much better than receiving marks eight weeks after the tutors had marked the weekly tests.

Good and fair.

Was beneficial in that questions and what was asked of us was very clear.

Good when the system was working properly.

Encouraged learning of course material.

Great; very practical and seems like it will relate well to what is expected in end of year exam.

It was very efficient, no delays in marking.

Very good - helps you to keep up with the work and to do extra reading.

It was a good way of assessing, and (supporting) learning for the students.

Good idea as you were given the correct answer and could use the tests as a study guide.

Good. I found it interesting, I think there should be more use of the computers.

It is a good idea. Provides a greater opportunity to learn from mistakes and understand; also being able to have a second chance (at tests).

Very good, very helpful, good notes.

It was different and quite interesting.

A good technique, keeping pace with technology. Very helpful.

Good way of revising work and seeing where the main emphasis is.

Moderately interesting, very helpful.

Not very happy at first, but it was okay.

EC110 is good, CO131/CO141 are bad.

I like it better than the other forms of testing.

Good, except the instructions were not always clear - could be improved.

Very good idea, perhaps needs better printers with more paper, otherwise brilliant idea.

Good, could get some example exam questions with correct answers - without any hassles - and could keep the tests.

Its good. Immediate feedback means you waste less time.

Much more beneficial - good.

Testing involves a greater understanding of the work, therefore through CML system students learnt more.

Appropriate for course. Tests you whenever you have time, and allows unlimited time for you to think over problems and work out what you need to study.

Constructive activity.

Very progressive, good move.

It was good, but the availability of more practice tests would help.

The testing was reasonable, the number of (computer) terminals wasn't.

I thought it was quite helpful - the fact we had three attempts (at each test) was good.

Good revision; makes you study.

It is advantageous as we can draw tests whenever we like, it gives you the correct answer if you are wrong. It would be good if it showed the working out for problem solving questions.

It is great. You can do the tests when you like, and as the pass percentage is high you need to understand what you are doing.

Terrific, very efficient.

Good; different medium for testing.

A good idea, good experience with computers also.

It was an effective way of testing our knowledge on the sections of work covered.

Very helpful, especially in relation to the weekly and end of semester tests.

It was effective because of the immediate availability of the tests and also the fact that we could work at our own pace.

Interesting, not a bad idea considering the large number of students taking the course.

Faster; a more independent feeling which was great.

It was good as it introduced us to different aspects (of the subject).

Great. It gave us a chance to test our knowledge and make amends for any gaps in that knowledge.

Easy to use.

Good, gives a good idea of the sorts of things we should know.

It was a good idea as it made you review your notes and it made it a little more interesting because you had to use a computer.

Easy and helpful in that the questions (issued) will help in the final exam.

I had reservations at first but it turned out to be simple to operate.

It was ideal to immediately receive answers to see whether your own responses were correct.

Good as you could assess yourself, but often the questions were ambiguous and you can't explain your actions to a computer.

Good experience with computers.

I think it is a good experience as we get immediate feedback on our performance and we have a chance to improve ourselves without loosing marks.

It is good. It would have been helpful if the answer that was given for incorrect answers could have been explained i.e. solutions shown to mathematical questions.

Good in feedback and immediacy.

I was dreading it - I thought it would be terrible, but after doing them (tests) I thought they were very worthwhile.

I think it is an excellent idea and enables you to gain valuable experience in answering exam like questions, also to become more familiar with computers.

I think it is good, we can go away and research the test, fill in the answers and actually find out if we were correct - unlike our other (weekly) tests.

Much better and more efficient method of testing; I wish we had used it in the entire year.

I think it is helpful because it makes you work. I need someone (or thing) to push me. You find out what you do and do not understand.

Very good as it made it essential to learn and understand the work.

Very convenient and very interesting.

Very practical and the speed of access is satisfactory.

Nifty idea - you were able to go when you had time - and I always managed to get a computer (terminal) when I wanted one.

Very detailed, efficient system.

Wonderful - it is of great help to immediately know your areas of strength and weakness.

The idea is good but there may be some major faults in its workings.

It was good as far as revision.

I thought it was an excellent idea as it made me revise my work more thoroughly and therefore be better prepared for my weekly tests.

Its fine, but it could be more user friendly.

Places more emphasis on the student initiative to have responsibility for their own tests.

Its quite a good idea; however, I would like to see answers and reasons for the answers printed out.

Better than any other thing we have done in EC110.

It was good; it was a benefit in several ways in helping gain an understanding of the subject.

Interesting. Different from doing the same thing all the time i.e. essays.

APPENDIX B

Convenient and comprehensive.

Good idea to help reduce the pressure of the exam paper (end of year).

I thought it was a good idea - more flexibility and time to think.

Convenient and clear - covers a wide range of questions on each specific area.

I thought it was a great help in understanding the work and doing practice questions.

Thought the system was a good idea, it meant that we were able to see how much we knew and were able to secure answers.

Efficient and worthwhile but must be supplemented by tutorial assistance.

Good idea, a little confusing at first to see how it worked.

Useful - would be more useful if explanations for correct answers were available - and reasons why incorrect answers are incorrect were also available.

At times a little confusing and it is time consuming compared to the supervised exams.

Quite good and pleasing.

It is better than the normal class testing.

Just an administrative time-saver.

Initially I was sceptical but found it worked well.

I was reasonably satisfied but I found the extra time required to partake a little hard to find.

Good for experience on computers - but not so good for part-time students who have not got a lot of time to get to computers.

Very good and very efficient.

Good teaching system.

I thought it was good; how you could actually take the test home and work on the answers at your own time, instead of answering them while you were on the computer.

Good idea - know if you were wrong or right.

Efficient; easier to grasp concepts of EC110.

It was helpful in learning maths relating to the course.

Good, enables us to have practice in theory and practical preparation for exam questions.

Able to improve marks. Answers actually helped increase knowledge, whereas weekly tests proved useless.

It was good, and you could work at your own pace - except for the first CML test (which had a deadline).

I think it was very useful and you were able to proceed more or less as fast as you wanted to.

Efficient - immediate results. Can go at your own pace.

Scary but rewarding, quite easy really but initially it seemed daunting.

Pretty good for learning the work especially if it took 3 times (attempts) to pass.

Good idea if inexperienced students had had some computer lessons.

It was a much better system for learning the content of the course.

I thought it was good and a worthwhile exercise.

Good, very simple to operate.

Not much.

It was very helpful and made you study the particular part of the course.

I like it, it takes the pressure off while still ensuring that you research a large amount of the work.

Excellent method of learning.

Very useful addition to the course.

It was fast. I didn't spend all my time chasing lecturers or tutors.

It covered all the options available i.e. it did all the organisational thinking for you. It gave one standard - not umpteen contrasting points of view.

An effective means of studying.

Good because you had time to work them out (answers), and then you could learn off the test sheets (revision).

I enjoyed it, and found it very helpful.

I think it is helpful (with the CML system), it helps you understand the subject better.

It was good - worthwhile. It was helpful.

I liked it, though it was initially intimidating.

I thought the idea was a good one, the immediate availability of answers was especially good.

Excellent, better than class tests.

It was lousy.

Allowed one to set own pace and learn from mistakes, less marking time for tutors and lecturers, lessen their workload.

I don't agree with it. It puts students with no previous experience of computers at an enormous disadvantage.

The questions were thorough and they were good examples for our weekly tests.

I was confused at first and didn't know what to do but eventually I became very happy with it after the first test.

Very good. A quick and efficient way of issuing and completing test.

Difficult.

Good - different and interesting.

Helpful, quite well set up e.g. taking questions away to answer, rather than having to answer immediately.

Pretty good.

OK, but difficult for part-timers to get good access to terminals - the printer was too slow.

Very impressed with it.

As far as T/F - short answer testing goes it was good.

It was good, it enabled students to research for tests, work through tests at own pace and discover errors.

At first not much, but after the first test I changed my mind.

A very good idea - will work well once all the small problems are ironed out.

It was good for revision - only thing is the system didn't allow for a range of acceptable answers.

Provides valuable learning assistance.

Not impressed.

Very good because it helps people to read the chapter and learn the subject.

Very helpful, it gave practical examples of the theory learnt. It also showed mistakes made by the user (learner) unlike the earlier class tests in EC110.

Just as much benefit was derived as from supervised tests.

Good - makes the course interesting.

Good way of learning/studying/revision.

Better than no tutorials at all.

I like the immediate feedback.

Excellent, it gives the students encouragement to read text and notes and thus for future testing proves extremely useful.

Quite interesting and inviting some sort of initiative.

I thought it was good - something new and different. Helps you learn more.

I think it has a number of good points:-
- (a) immediate feedback of answers
- (b) impartial marking
- (c) impartial questions.

Good idea - enabled you to go at your own pace.

Not very much.

Good - however, disagreed with weighting in Modules 2 and 3 - specifically in calculation of M2, Money Base etc. Would have been better to have given a point for each correct component, rather than 1 part out of 4 being wrong and judged nil marks.

Excellent means of training with feedback and self paced learning.

Good, certainly faster feedback than the tutors.

Very good - it makes you do some study, allowing you to test yourself, and see how you are going.

Great; results immediate, plus it told us the correct answers.

When everything works (i.e. equipment, printer) the system is good - allows more flexibility than usual written assignments.

Not bad. Places considerable strain on part-time students - if you live a reasonable distance from the University.

OK, except for the problem of failing tests because of printer malfunction - should be able to draw another copy of a test from the computer before being asked for answers.

At first a little worried, but it was good to be able to have tests immediately marked and have immediate feedback.

Excellent concept - we are presently developing a similar system for the entire training programme of Westpac Banking Corp.

Good, efficient - easy to understand. Good change from the ordinary assessment procedures.

Very good. Was able to obtain a much better grasp on the tested areas.

Excellent concept - provided a great learning experience.

QUESTION 3

What did you think was the greatest advantage of the CML System?

(where the same answer was provided by more than one student the number of such comments is indicated by ( )).

Doing tests at your own pace/when you liked. (21)

Immediate feedback (results and answers). (10)

Immediacy. (3)

Revision. (3)

Three attempts (at each module test). (3)

Easy marks. (3)

Immediate feedback on results. (3)

Saved time. (2)

Could get 100% on tests. (2)

Being able to do a test when you felt like doing so. (2)

Actually being marked.

We were able to take them home (tests) and were able to work at our own pace.

Availability at any time.

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The greatest advantage was as a revision program and also showing the style of questions possible for the material covered.

Feedback from the work I've been doing.

Could do it in your own time.

Everybody was willing to try it out and therefore learnt something.

Preparation (for assignments) can be at your own pace with no deadline in the immediate short term period.

Being able to take the tests away and use them to help in study.

We can do the tests without much pressure.

Greatest advantage was that of taking the test home and being able to follow through notes and the text to find the answers. The work covered by these tests has stuck in my mind more than any of the (other) work done this year.

It helped me understand the subject material a lot better.

It allows us a better understanding of the work we are doing.

The greatest advantage was that you could go at your own speed.

The convenience of doing the testing at a time that suits you.

Being able to keep the questions for future revision - unlike our weekly tests.

Easy application; less writing.

Fast, but you could do it in your own time.

Its availability of use i.e. not kept waiting.

Three chances (at each assignment), answers to errors.

Quick, done in own time.

Easy to operate.

Getting results back immediately.

It promotes greater learning effort.

Obtaining the correct answers.

Efficiency and accuracy.

Being able to attempt the test and then being shown where I went wrong - unlike the weekly exams.

Gave examples of the kinds of questions that we could be asked (in end of year exam). Showed what areas I needed to attend to.

Immediate answers for assistance in weekly and end of semester exams.

Made you study a whole range of topics and you received your marks and where you were wrong. Much better than the weekly tests or the old way of doing assignments.

The problems covered not only theory work but also practical work, which is not really covered by examples in lectures.

Being able to do the tests when it suited you.

Being able to work on the tests at your own pace and having a second chance.

Better than tests conducted in lectures - opportunity to gain better results.

You obtain the marks immediately and you are able to see which questions are wrong and get the right ones (answers).

Being able to obtain not only marks but also answers to questions you were unable to answer (correctly). Lets you know where you went wrong and why. Reinforces theory done in lectures. Excellent test preparation.

Self motivated, applied and assisted form of assessment as well as immediate response to answers.

Being able to know where you have made mistakes and therefore learning from them - unlike the tutorial/lecture tests.

The results were instantaneous; there was a good range of questions.

You can do it at your own pace and in your own time.

At my leisure I could do what I liked.

You can basically do it at your own leisure i.e. there is no pressure or rather less pressure which is a great advantage at Uni.

How much you put in (effort) is proportional to how much you get out.

Results were immediate and made for greater consultation with notes on grey areas, and for (indicating) wrong and right answers.

Allows you to go away and spend time working through questions.

The fact that you were able to take time over the exam.

Unlike the previous weekly tests we find out (straight away) where we were going wrong.

Easy to draw assignments - more efficient.

Easily accessible; helps sort out problems.

Being able to do the tests when it suited you i.e. you had time to study. Get results straight away.

Get more insight into the course.

The best advantage is the quick feedback i.e. immediate marking of the tests.

It was advantageous in it allows for 2nd and 3rd goes at an area of economics, resulting in a bit more being learnt on each go.

Immediate results, good practice at type of questions to be asked in topic areas.

Get a test at any time.

Allowed to work at own pace and at whatever time suited best.

Computer experience. Advantage of taking tests away; having answers immediately.

Not as much pressure as in an exam and you get the results immediately.

Your tests were corrected straight away - learnt more.

Questions were good for revision. Picking out trouble areas.

Being able to work at my own pace, and being able to research for myself and not have to fill essays with irrelevant drivel.

Self-paced testing - immediate marking.

Using the computers themselves.

Learning by mistakes - getting three chances at each assignment.

You could do it in your own time. It also provided an easy means of getting in touch with the lecturer (electronic mail).

You can get immediate feedback on results; you don't have to wait for tutors to mark tests/assignments.

Practice for final exam; incentive to go through work.

Being able to take the print-out away and work on it when it suited me, instead of exam conditions under which I do not do as well.

Practical work on theory we'd covered in lectures.

Instant feedback on how you did in the test.

It was a self-paced course; test papers retained for reference, instant marking and results, additional chances to complete the test modules.

Instant feedback and progress is according to the students pace.

Time flexibility. Having three chances to pass and not as time consuming as assignments.

Being able to do the test when it was convenient; being able to do the work at your own pace.

Work at own pace; three attempts (at assignments) if necessary; questions similarly designed will appear on exam.

Studying can operate on a more flexible basis.

It gave your results straight away.

Being able to do the tests at your own pace and being able to work through the finer points of the topics mentioned in them; finding out what is important to know before the end of year exam.

It makes you read the weeks lectures, and is useful as a study guide. The best aspect is that you can take the test away, research it and consequently get the right answers.

You get another chance if you failed; you could take the (question) sheet away; the questions are of the same nature as the end of year exam (questions); correspondence with tutors (electronic mail).

Get practice at questions; get to know which questions were wrong.

Getting marks immediately and doing it at your own leisure.

Allowed students to complete assignments in own time. It was also a novelty.

Individualised tests and the ability to access tests at your leisure.

Able to go at own pace; much more pactical, its faster than the tutors.

Being able to keep the test papers, and learning from any mistakes made.

Our papers were marked very quickly plus we got to see the right answers and could better understand what we'd done wrong.

You received immediate results on entering your answers into the computer, and learnt by being able to re-do the material.

It's like doing a lot of practice tests, which is good.

Given time to work out problems; not in assignment form.

Marked immediately, able to take question paper away.

Maybe less work for lecturer.

Making people use the theory they had learned. Mistakes made were identifiable - unlike most of the weekly tests.

It was there when you wanted to use it.

Enables one to work at own rate and deliberate over answers. Easy marks.

Work at own pace.

Revision - do work in your own time - three attempts at each test.

Can do it at your own pace - have ample time to complete and understand questions - a good study guide.

Allowed to work at own pace and use open book to work out answers.

Good revision opportunities.

The student has time to complete the questions at his/her own pace and with outside help (tutor, peer, etc.) if necessary.

You can work through the tests at your own pace. Immediate marking and chance to re-do failed tests.

Knowing your mark as soon as you answered the test (not waiting for weeks/months as for tutor marked tests).

Easy, quick, effective.

Good opportunity for revision given - practice questions for end exam - three chances to pass each test, and see your mistakes.

Speed. You get more than one go.

Practice at answering problems.

Did not like CML approach.

Is faster in marking your tests, you can get your results more quickly.

It allowed you to test yourself and see where you went wrong - cf. tutorial tests (supervised) where we never knew where we went wrong.

You could go away and look the answers up in books.

Having a copy of your tests for revision - having (up to) three attempts (at each test).

It makes me learn the work progressively and saves "cramming" at the end of year.

Its use as a study guide - by answering the questions - knowing what you should work on.

It is quick and you can do the tests in your own time.

Able to know exactly what area (of the course) you need to study.

Three attempts (at each test if needed) and time to write answers at own pace.

You were able to get better marks easier - made me read my notes more - better base for learning the work.

Well, it makes you think and learn as you go along, and it also provides answers to wrong questions. It really makes you think.

Students were able to take their time in answering the questions and therefore learnt more about the topic they were being tested on.

Its efficiency, previously I had to wait for weeks before the marks of our tests were out. At least with the computer based tests the marks were available promptly.

Good revision and helpful in preparing for end of year exam.

You could see where you went wrong - you were given the correct answers.

It made me study the chapters.

Indication of the type of questions to be expected in the end of year exam.

Keep up to date with course material.

Efficient, good teaching aid, good for learning.

You are able to do tests at your own pace and don't feel pressured by it even though it requires you to go through and understand the work.

Ability to do tests when it suited you. Incentive to do something in the subject - its boring otherwise.

Questions, problems.

Enabled progressive assessment that was interesting to do.

Availability.

You could take the test home and research the answers, therefore learn and study at the same time - (computer based) tests provided motivation.

Gives greater idea of what the exams are likely to be like.

Can work at own pace. No pressure to swat night before.

Having sample questions before the (weekly) tests.

Quick marking of tests allowed me to find out where my problems were immediately - it directed my study to where it was needed.

The fact that it provided immediate feedback and also provides examples - with corrections - of practical applications of the lecture material.

Immediate results; short answer type questions (not essays).

Convenient, easy to use, actually got a view of what the course was about.

Self-paced; no strange questions as with micro (economics) and macro (economics) part I.

Feedback on questions (answers) facilitates learning.

Gets people used to using computers.

APPENDIX B

Being able to take a test away and come back later (with answers).

Getting three attempts (at each test), and telling you where you went wrong.

Several attempts (at tests) aided learning.

You could go away and look up the answers.

The speed and availability of the tests when you wanted them.

Being able to take them (tests) home and find out/work out answers - unlike weekly tests which are guesses.

Gives you some idea what is to be tested; shows you what you know and what you don't know; able to do tests at own pace.

Questions corresponded to the notes given, and gave some practical application of the theory in the problem solving questions.

Time advantage - I can do it (test) at the least busiest time in the week. Also, its good for preparation being given the test.

That you could take them (tests) away, work out your answers and see where you went wrong.

Easy to get marks.

Ease of marking; fun in using, (fun) passing the tests.

Convenient, provides a wide range of possible exam questions.

You were able to learn a great deal more of what is relevant, rather than learning irrelevant facts.

Immediate marking, extra testing practice.

Speed and efficiency.

You could do it in your own time and encouraged people to learn for the subject.

Time saving, convenience.

The feedback, to see where I went wrong so that I could correct my ideas - cf. no feedback in previous (tutor marked) EC110 tests.

Took weight off the end of year exam.

Able to take tests home and work at own pace, able to keep tests.

Can find out results of tests and where you went wrong, incentive to study EC110.

More beneficial than weekly tests (tutor marked), convenient to be able to draw tests whenever you want and answer them whenever you want.

I did it.

Its immediacy and facility to let you work at your own pace.

It tells you the correct answers to questions you got wrong.

Easier.

Allows you to work at own pace; easy marks.

It was quick and relatively easy to use.

Helped me to locate objectives of the course, and what parts are more vital than others.

Its use as a study guide.

It is very helpful in enhancing our understanding in EC110.

Getting exam type questions.

Immediate feedback, also helpful in preparation for exam.

It makes you keep up, gives you a better study guide - more specific.

Advantage of researching your answers which involved a great deal of work which is helpful for your study.

Active study process.

Easy marks - good learning activity.

Time to think about answers.

Is easy and quick.

The time available to do the test.

Simple to operate, immediate results.

Practice at solving problems.

I had to do a bit of work to complete it.

You had a chance to go and make sure your answers were correct.

It gave the students a better chance of passing.

No study; is available all the time.

It was pretty hard to fail.

Easy access, no disc needed to access the system (as in CO131/141 CAI).

Can do it at your own rate, learn more as you have to find the answers.

Allowed item to research the answers.

Made me look up the book, look up lecture notes, learnt better.

Its practicality. Practice what we learnt - you can do it when you like.

Quick to use. You were able to read and research into your answers as well as attain help.

Ability to try again (at tests) to score a pass.

Testing, having a basis to study from.

Flexibility of when to answer the test; relative lack of pressure.

Being able to take test home to do, therefore getting use of information (from test).

Kept you up to date with the work. Acted as a reasonable substitute for tutorials.

I can test myself to see if I know the work.

Gives us an indication of the exam (end of year) in this subject.

It was marked quickly, unlike our weekly (tutor marked) tests.

APPENDIX B

Easy marks for doing very little work.

It gave me some indication of the types of questions/application of facts for the end of year exam.

You were given corrections to your mistakes, so you could see where you went wrong.

Able to do tests in your own time, and to have them marked on time made you study the relevant sections.

You could do tests when you were ready, the tests were retainable for future reference; they (tests) were an easy 10%.

Taking tests away, working on them, and then going back to the computer. You learn more, and it was novel.

You get time and you can use available resources to answer the questions, even though some of the questions are difficult.

Immediate feedback; analysis of the work you had just completed (in test).

Immediate feedback of results; able to draw tests out for a period of time before having them marked.

Provides a basis for supervised tests, and gives a good source of revision from the printouts.

Chance to read in depth about the problems (test questions) ensuring maximum understanding in weak areas.

Gives you an opportunity to take tests home and think about questions and thereby give better answers and increase your marks.

The variety of questions used and we could work at our own pace and complete the modules at times to suit us - except for deadlines which are fair enough.

We get answers immediately, it really helps because we know where we went wrong.

Helps you to find out and learn what you need to know, helps you find out where your areas of weakness are.

Lets you know what is required in the course; a good source of revision; practical examples are a good way of learning.

Much better than class tests which were never given back, therefore didn't provide any feedback.

Immediate results and retainment of tests for further study; would be good if used by the Commerce Department.

Its ease of use and that you could take the test away and return later to enter answers. It could be completed at your own pace.

Immediate feedback about results - especially compared with the slowness of results from other forms of assessment.

The fact that you had three attempts at passing each module (assignment) was a unique and beneficial concept.

It made you revise your work and thus made it easier for the exam. Also, it was a good idea to have 10% possibly reduced from your exam.

APPENDIX B

You were able to test your knowledge and it also gave valuable study material for examinations.

Time to go home and work out the answers for the assignment, and it gives the correct answers (to those answered incorrectly).

It gave me up to three attempts at each module, and I could keep the test and have all the correct answers for study purposes.

Go home and do it (test) ourselves from notes and textbooks. It helped with understanding some topics when we discussed them (in lectures).

You could take it with you and get help in understanding (the subject), whereas in an exam you either pass or fail and you start to not care.

I could work virtually at my own pace and get the marks back immediately, also I can use the assignments for revision later on.

Gives students some extra time for other subjects but still have the same knowledge (of this subject) - don't have to waste time writing essays.

Marks quickly; able to draw tests whenever suits; three chances at each assignment.

Doing tests when you had time - fitting it in around your other work; you get to keep the questions and answers for later exam study; you may have trouble (fail test) but you get another attempt.

The test can be drawn at any time and be corrected whenever completed. No "formal" assessment and more freedom allowed.

That you can draw out tests and you can see how well you are progressing.

It made you learn and understand the work.

It lets you know almost immediately how you are going. It is NOT human.

You could get more than one attempt (at each assignment); you got immediate feedback about where and how you went wrong; also, the questions were clearly broken up to cover all of the subject.

Find out which answers were correct for revision purposes, and understanding work.

A readily accessible chance to gauge your current knowledge about the course and see how you are progressing.

The questioning is similar to examination format so it is worthwhile in that respect; they (tests) are a challenge.

It let you answer the questions at your own pace and gave you a second chance. It was also quite easy to draw a test (off the computer).

We can study the test in our own time, there is no time pressure in answering the questions - no "exam fear" which can often cause mental blanks.

Can look at the book to find the answers, therefore learning at the same time.

No immediate time limit/restrictions on tests. Not much time actually spent on the stupid computer.

Tests were immediately marked and we had (up to) three attempts per module. Marking on the basis of 0 marks or 5% for the tests forced students to study - which is unusual for EC110 - so there will be less work for the exam.

Helped with revision in that questions tested across all the subject area - unlike an essay.

Getting to keep the questions for further use and getting the correct answers as opposed to just getting a mark (cf. weekly tests) months after doing the test.

Could do tests in your own time - workload in other subjects does not always allow you to study for weekly (tutor marked) tests.

Do tests when you have the time; not when you have to - very important around exam times.

Ready to test at any time - not rushed over like the weekly tests. Time to think about them (questions) - much broader in scope, encouraging learning.

You could do it (test) at your own pace, having a week (or so) to do it. Better than having set weekly tests which can be inconvenient.

Three chances at each module test, and that you were given the correct answers to questions you answered wrong.

Better chance of passing EC110, rather than using weekly tests.

Having further chances to pass the modules ensured that you actually learned how to do the questions.

It was good.

Raises issues I'd never heard of in lectures.

It gave the answers immediately and did not entail setting out written assignments.

Giving the right answers if you were wrong.

It gave the right answers whereas weekly tests don't provide this. We were able to take the tests away and think about the answers.

Having a preview of the questions and being able to complete them in our own time to the best of our ability.

Relatively quick - although waiting for print out (questions) was sometimes time-consuming.

With questions you had wrong you were told from which part of the module they came from (i.e. which objective).

You have to learn as you go along.

It gave the style of questions to be expected (in final exam), the style of question to be used in the other sections of EC110 is unknown to me.

Getting the corrections and marks immediately.

Allows a student to know how they are progressing; reduces written work.

Enabled students to work on tests at own pace - and research for them.

You find out results immediately and if you don't do well you get another go.

Getting three attempts at each assignment since its (often) only by the second or third attempt that you understand the subject material involved.

It allows greater flexibility - could do it when it suited. Also, it gave immediate feedback - in direct contrast with the tutor marked papers.

It shows how to tackle exam type questions.

It made you learn and understand more the theory of macroeconomics.

Having the results immediately available.

Taking it at your own pace.

Having the chance to look up your lecture notes and textbooks before answering.

User (learner) control and flexibility.

Helps learn and understand the work given in lectures.

More attempts to do a test.

Constant work through the whole of this section of EC110 and kept us studying/reading throughout all of it.

Being able to learn where your mistakes were made, also had (a copy of) the questions to practice on.

The immediate results.

Lower pressure; no pressure to have to sit and finish tests within a certain time.

The analysis provided of questions answered correctly and incorrectly - as compared to the (lack of feedback with) supervised tests.

Able to research (for the answers to the) questions.

The opportunity to reflect on the questions.

Indicates some possible exam type questions.

Providing a greater scope for learning as the tests from the other part of the course were of no value as the answers were unknown i.e. not provided.

Rather than turning up unprepared for a supervised test the computer tests encouraged students to study the topic and therefore learn the work more thoroughly than perhaps they otherwise would have.

If you failed first (attempt at a test) time you could sometimes learn from your previous mistakes.

Provides valuable learning assistance.

Work at your own pace.

Being able to take test home and work on it without pressure of classroom atmosphere. I felt it helped me learn more efficiently than cramming for each test - time for part-time students is very precious.

Pace is personalised; multiple attempts (at tests).

APPENDIX B

Able to go at your own pace within the constraints.

Incentive to study for work covered in module; immediate feedback.

Immediate feedback; next chunk of assessment immediately available.

Helps in revision of theory, would be good preparation for exams.

Convenient, you could work at your own pace.

Immediate feedback of correct answers; practical problems.

Convenient, could do it at your own pace; told you which ones (questions) you had wrong.

I was able to govern my time according to work load.

There wasn't one.

Being able to have three attempts to pass each test and being able to keep the questions for future reference.

You could take the exams home and work on them in your own time.

Could work at your own pace and obtain a much better understanding.

Pass more easily.

Being able to take the tests away to do them.

It provided an immediate result which included feedback on wrong answers.

Instant results; extremely quick, no hold up or queue to get onto computers.

You could do it (tests) when you had time and felt you could understand it.

Self timetabling - particularly good for part-timers.

Being able to find out what answers were wrong, not as in "normal" (weekly) tests where there is no feedback of incorrect answers.

Being able to have the questions, go home and answer them; then enter answers on the computer and get results immediately.

None.

Speed with which you could get the next test, and the speed at which the computer marked them - better than tutor marked tests.

Instantaneous feedback of answers to questions.

Fast and clear.

The fact that it gave three attempts per test is a definite aid to learning as you can tell if you have not learnt the material properly and can correct your mistakes.

Own time to do it in.

Could pace yourself at no-pressure level. Had correct answers available for your incorrect answers. Made you fully revise your work.

Get answers back immediately, so knew where you went wrong.

Individual and can take tests home.

You could work at your own pace.

APPENDIX B

Getting answers - provides a good learning experience.

Ability to get questions which will be similar to the format of the exam, plus excellent way of non-pressure testing.

Quickness of marking.

We were able to work at our own pace and it gave us a wide variety of questions and topics to study for.

Able to do tests at a variety of times; learnt more as able to take time to study data (course material).

Instant results. Available for use at all times (almost).

Take home exams - time to think about questions.

It entailed good thorough learning and the results were immediate.

Immediate feedback on results, indication of which objectives you had failed and the correct answers.

Self paced, instant results.

Immediate marking of tests and feedback.

It made clear the theory taught in lectures by use of practical examples.

Helps revision.

We could use the tests for revision.

The feedback and variety of tests leading to extra experience in the subject.

Instant feedback - great because the tutor marked tests took so long and therefore were not helpful. Tutors should be employed to assist people with the CML system.

The lack of an "exam room" pressure; the time flexibility and instant marking.

Self help. I learnt more than if there had only been one attempt per test, less stressful.

Good for feedback on how you are going - encourages immediate study of material covered, rather than learning it all to the end (of the course).

Easy.

Less tedious writing involved (no written assignments).

Three attempts (at tests), immediate feedback.

Could work at own pace.

Instant marking.

It allowed you to learn from your mistakes because the answers were available.

A smaller workload for the lecturers.

It allowed study for a subject difficult in content. The assessment was what had been learnt, not what had been tested.

Allowed you to progress at your own pace; allowed any incorrect answers to be displayed.

That you could take your time and that you received your results straight away.

The fact that you had three attempts if necessary; failing first time doesn't mean you don't know your work. Instantly marked - don't have to wait five weeks for tutors (to mark tests).

The fact that you could take the tests away and learn the material and compare questions with the material.

It tested your knowledge. Instigated me to do some work. Good incentive when you got the questions out.

Immediate feedback, and answers to questions were available - thus you were not proceeding in the dark, not knowing the answers.

It was significant in motivating you to study that particular part of the course.

It enables you to proceed at your own pace and allows lecturers to get some idea of whether students are learning anything from the course. It also helps in the understanding generally of the subject due to the nature of the questions issued.

Feedback - could never make the same mistake twice. Three chances (at each test).

The immediate feedback; the chance to re-do it (test) if not correct.

Being able to complete tests in own time encouraging one to constantly refer to text for confirmation of opinion.

Flexibility.

Can do tests in your own time.

Ability to concentrate on tests in own time rather than being tested immediately after two hours of laborious lectures.

Self paced and immediate reply.

That we could work ahead as we wished, and we had an idea as to the relevant emphasis of the course topics.

Time (was) permitted to research answers.

Could take the test and check on any answers you weren't quite sure about.

Immediate response with results.

Allowing students to progress at own pace.

A chance to do some practical thinking. A means of recall and instant feedback. A means of assessing further questions to strengthen weaknesses.

Flexibility in time - and in future progressive assessment. Obtaining correct results immediately. Satisfying to know you can pass (tests) even at 85% (pass mark).

Doing it in your own time. You learn a lot more from the CML assessment than you do from those stupid little exams each week that only a minority of students bother studying for.

It helped me to learn the subject better by reviewing the lecture notes and the text.

Instant marking.

Find your weaknesses.

Questions were very direct and easily accessible. You get time to think and research the questions.

Immediate evaluation. You are able to keep the test for later reference.

Can structure your time and study to suit your own situation. Made me study a bit more.

It gave incentive to study with a reduced final exam percentage. It gave automatic feedback where you were going wrong. Lecturer and computer supervisor were very helpful and filled the gap for the non existent tutorials, which to my knowledge is an issue that has continued to be unaddressed for many years.

You can do it (assignments) at your own pace and you find out the answers to the questions you get wrong.

A means of testing yourself and evaluating your performance. This meant you had to keep up to date, which is good.

We found out which answers were right/wrong - then able to go away and find out why. Get the tests when we wanted and do it at our own leisure. Also tests counted for 10%, which is a good idea - would have preferred this type of assessment to be worth say 25-30%.

QUESTION 4

Did you experience any frustrations with the CML System?

No **Yes (if Yes please indicate)**

No = 265
Yes = 189

(where the same answer was provided by more than one student the number of such comments is indicated by ( )).

Printer malfunctions - or out of paper - losing tests. (12)

Printer failed to print one of my tests. (10)

Getting print out of test (printer problems). (5)

Failing a test. (2)

Poor wording of some questions. (2)

Some questions were a little ambiguous. (2)

Printer running out of paper. (2)

Not being able to bring answers to incorrectly answered questions back onto computer screen. (2)

Only when someone had played around with the printer. (2)

Failure of printer - I did not receive all the questions to one of my tests. (2)

When I got some of the questions wrong.

Not understanding how to use the computer.

Problems with passwords, other minor interface problems, but help was never far away.

Ready for Assignment 3 and it was not available.

With the password at the beginning.

Trying to pass.

High pass mark.

The questions were too ambigious and the marking too dogmatic. The questions were often too vague.

Having no experience with computers I made mistakes, however help was always at hand.

Some questions were in fact marked wrongly on the computer - but this wasn't so bad when you found that you were right and the computer wrong.

Study guide facility was unavailable. Extra (practice) tests could not be done.

It would be advantageous to be able to draw three tests even if you passed the 1st one, because it gives more practice in applying the principles learnt.

Some of the answers were wrong in the computer.

Once I was unable to obtain a test as the printers were down. This put my whole program out of kilter (involved running around to fix it up).

I didn't read the instruction book and I couldn't get into it (computer).

The instructions could have been a bit easier to follow. Also, possibly some answers that were really correct were marked incorrect by the computer.

Ambigiuous questions that could be interpreted a number of ways, but problems were easily overcome.

Computer never showed me where I went wrong in my 1st and 2nd attempts at Module 1.

When the computer marked your correct answers incorrect, or didn't explain why they were incorrect.

When asked if I wished to change any answers I said yes but it didn't let me.

If you don't get the required percentage you get 0 (marks). This is completely unfair as you can earn 74% and end up getting 0 credit, as in the 1st assignment.

How the computer accepts answers (e.g. -5000.00 not accepted).

APPENDIX B

Failed an exam for forgetting to put in a negative sign which I had indicated on my written sheet - inflexibilities of the system.

I much prefer human teaching and classroom testing, I achieve greater understanding this way.

Understanding exactly what was required of us. It wan't explained clearly enough.

Pressing return key twice to get your test printed out.

Once it almost took an hour for the computer to print out a module test.

Confused on the answers to be given e.g. +ve or -ve answers.

Not understanding how to use the computer.

When I got some of the questions wrong.

Calculation questions (e.g. worth 10 marks) should have been divided into sections to see where we made mistakes, instead of just getting zero for the question.

One of my tests was forfeited because of some mistake, but I think it was because I rushed through it.

Punched in M for millions when I didn't need to, I failed (test).

The problems posed in the tests are not in line with the material covered in our set textbook.

I kept failing.

Not enough computers to go around, have to wait too long for your printout (test questions).

When it (computer) gives incorrect answers.

Sometimes it takes a while before it continues to the next screen.

I kept failing by about 5%.

Failures and forgetting to check that paper was in the printers.

Only when the computer said it had printed a test and it hadn't, but that's only mechanical - otherwise its great.

Test was lost in system because printer was not functioning properly.

The computer rejected my password so I had to form a new one.

No worked examples given with answer explaining where you went wrong.

Printers being temperamental.

Waiting five minutes for a test to be printed on one of the printers.

A few initial problems promptly rectified.

Put wrong answer into the computer when I had the right answer, and failed test because of this (made me bloody mad).

The printer kept "mucking" my tests up.

Answering the questions.

Understanding it (CML system).

Random printing of test papers, i.e. tests not chronologically issued from computer.

Confusion as to how to actually operate the computer.

It was no challenge, I found it too easy.

It (computer) wouldn't accept my password.

Quite an easy system to operate.

Marking not consistent among different people.

Some problems with entering data.

Slowness of computer when many people simultaneously using it.

Couldn't get into it initially, and help wasn't always available.

Didn't really understand what I was doing.

Unable to communicate with the computer.

At first I was at "panic stakes", but have enjoyed it.

Couldn't get all three tests (assignments) as quickly as I wanted.

Minor errors in calculations leading to large loss of marks (in test).

I didn't get a test printed and had a long wait (for help).

Printer jammed on one test and had to get help to get another (complete) copy. Some questions ambiguous and at variance with text material.

A few problems getting on to the system.

At first it was a bit difficult to work out what to do, but after a while it got easier.

The answers didn't stay on the screen long enough.

You shouldn't let the same questions be printed in tests (for a particular student) within the same module.

When supervisor is not available and the computer has faults.

Had a couple of problems, but help was always available, therefore no problems.

Sometimes unclear about what computer was doing and how to override system to abort proceedings.

Didn't indicate you had to use negative sign in balance of payments deficits.

Printers failing to issuing tests and being delayed while waiting to see computer room supervisor.

Lost two tests due to printers playing up.

Having to wait a long time for printer to print out a test.

No instructions on printer - thus not able to check printer setting in advance of drawing tests.

Every now and then the printers seemed to malfunction, so you had to wait longer. Also, need faster printers.

If questions were ambiguious. Also, some questions referred to situations not covered in handouts or set texts.

Printer only printed out half of my first test.

Only when I failed the third test twice.

Pressing the wrong buttons (keyboard) and as a result failing. Having to wait a fairly long tiem for a computer print out (test).

It played up on my answers at least once, maybe twice.

Trying to get onto the system; rounding off answers.

Lack of paper in printers - lack of printers - too many students in course.

Inconsistency of computer when marking questions.

It is too easy to fail a test - only need to get two multiple choice questions wrong.

Calculations worth ten marks, you are not asked for your working out - so if you make an arithmetic mistake you get nil out of ten - and as a result fail the test.

If you get too many questions on a test that are very similar, rather than a range of different types of questions. Also, if you pass the test (on say first attempt) then you don't get to see further examples of questions.

Not being sure of the procedure for drawing a test from the computer, making a mistake and having to wait five hours before I could get help.

No, other than having to do the first module (assignment) three times.

Getting the test questions printed out on the old (slow) printers took an extremely long time, and there would have been a maximum of 25 people in the computer room at the time.

Printer did not work correctly for my first test, fortunately Mr. Cook was able to correct this as he was there at that time.

One question had negative sign in front of the numerical value which was correct, but the computer marked it incorrect.

It gave me a wrong answer on the 1st test (1st attempt) paper, therefore I got the 1st test (2nd attempt) completely wrong - I passed on the 3rd attempt.

Getting out of the system.

Had trouble getting a test off the system. It wouldn't print and I thought I would lose an attempt at the test.

When paper ran out on the printer - causing me to forfeit my 3rd test.

The feedback for my test blanked off the screen quickly and was lost - I don't know where I went wrong with the test.

First test incorrectly marked.

On my first test the printer didn't work, other than that an excellent system.

You couldn't get additional questions after passing a test.

Unsure of how to work it i.e. when I made a mistake in the middle of the programme.

Not being able to get out next module.

I couldn't draw tests from modules I had already completed.

APPENDIX B

When the printer did not print my test and the computer had recorded my test as being drawn.

After sending message to the lecturer on the computer (electronic mail), I could not get off the system.

When changing answers, the program did not indicate whether to choose the specific question (i.e. 16.1) or the question in total (e.g. 16).

Didn't know the answers.

When a correct answer was marked wrong.

Similarly worded questions marked differently on subsequent paper.

Lack of terminals at times.

Quality of printer, keyboard difficulties, time consuming.

Negative sign on keyboard confused with hyphen - system not able to cope with typographical error.

No paper in printer at times when part-time students are likely to use computers (I know you suggested getting into groups to buy paper, but this is more difficult for part-time students).

Printer failure - perhaps a prompt could be inserted to allow tests to be immediately re-run in the event of a malfunction via another printer.

Probably only due to the lack of computer experience.

Only the programming of questions - some were very ambiguous and of course there was no room for argument.

At first acquainting myself with computer procedure and vagueness of instructions for test issuing.

Very slight - one of my attempts did not print out.

Initially yes - until I had read the instruction guide.

I got 74.4% for the first test (pass mark 75%), otherwise no.

Because I put my answers into the computer in the wrong format I failed the test. Printer failure with my second attempt.

On weekends no paper in printer, also problems with the ribbon in the printer. However, these problems were overcome, Mr. Cook was always available in the computer room.

Doing the second test I got caught into giving answers before I was ready.

There was no way I could dispute a fine point on the answers with the computer (e.g. +400 not seen to be equivalent to 400 or $400).

Computer didn't print out one of my tests, yet expected answers to the questions. Couldn't find anyone to help explain the situation to me.

Printer not printing out tests. More explanation needed prior to use of CML system.

Some wrong answers (on computer). Very slow printer.

Very minor. Getting onto the (CML) system was sometimes not simple.

System is not particularly "intelligent" i.e. if answer is correct but given in wrong format then answer marked wrong.

System was too picky about the form in which you expressed numerical answers. No previous computer experience so I had no idea. Rejected correct answers due to wrong format.

After requesting the first assignment it took ages for the test to be printed.

Corrected answers that appeared on screen disappeared too fast.

Not really frustrations - takes a little time to adjust too, but it was relatively easy to use.

I hit the wrong key and it went to the next question - but I eventually got it fixed up.

When I had answered a question incorrectly it didn't adequately explain where I went wrong.

When I failed 2nd test I forgot to check answers and couldn't get them back.

The printer went off-line and the issue of one test and the answers to another were lost.

I couldn't use a computer.

The 3rd module test took so long to be printed out.

Having to get extra tests out after failing one.

I couldn't answer the first exam and wasn't sure how to proceed. Too embarrassed to ask for help.

The printer was off-line and did not issue two of my tests.

It (printer) chewed up my test.

Waiting for my test to print out - minor thing.

Took Module 3 test out of computer and answered it, but had problems entering the answers. The printer didn't work for one of my attempts.

Computer is too precise in marking some of the calculation questions, also it does not give specific feedback, i.e. step by step, for calculations to indicate where you may have gone wrong.

Loosing the feedback (summary of test results) at the end of a test.

Ambiguity of instruction procedure when drawing a test.

Tutors would have been more accurate in marking calculation type questions and been able to allocate part marks for small student errors.

QUESTION 5

Would you have liked the CML System in the entire EC110 course?

Yes = 446
No = 43

APPENDIX B

QUESTION 6

Would you like to see the CML System in other courses?

Yes = 409
No = 63

QUESTION 7

Do you have any other comments about your experience with the CML System?

No = 309
Yes = 145

It was fun. (2)

Very helpful. (2)

Slightly better printers would be helpful.

Computer games should be implemented - to spark students interest in computer work.

Very pleasant.

In some cases it would be helpful to have some of the answers printed up for the ones we had wrong - i.e. (plus) a brief explanation.

Should be continued.

Access to the computer could be lengthened to a little later at night; no two tests being the same is a good idea.

We were still not given any feedback on the questions in the tests, however; i.e. no direct explanation of questions answered incorrectly.

More feedback (such as provided by CML system) required; the weekly tests are no judge of performance - they are a joke.

Operation of CML system (instructions) should be issued (printed) to students before they commence the work.

I think each test should have equal marks (e.g. 50), I've had one with 47 and one with 29.

It has also helped me with the weekly supervised tutorial tests.

It would be good to see if CML could be introduced into EC134, to make this subject more interesting.

As a part-time student access to the computer can be a major hassle.

There are still no explanations given for answers, organised tutorials would still be a vast improvement.

I think one of the T/F answers was wrong on the computer.

Would like more control over CML system.

It may take some time to get used to it.

Pity it wasn't brought in earlier into the course as it would have greatly cleared up understanding of problems.

It is very good that it is something you can do entirely on your own.

The questions were a bit ambiguous.

If there was greater assessment placed on this, students would be encouraged to work more consistently throughout the course (weekly "joke" tests didn't achieve this).

When I approached the tutors regarding questions I could not answer because of the terminology used and I had not encountered in lectures or texts, they couldn't answer them either.

It would have been good to have sources or references where we could obtain the necessary information to answer the questions.

You need to give students better instructions on how to use the keyboard, for example if you did not correctly select the negative sign for a negative answer your answer was marked wrong.

I'm glad I did it, and given the chance I'd do it again.

Better practical examples than in (weekly) tests.

Nothing except that it is reasonable that the questions used will be available in texts, thus enabling the whole system to be done by computer.

I think that the tests could only cover a limited area of material; there are certain advantages in failing first attempt at tests as you get a greater view of the course topics.

It would be a better system if the questions could be answered by referring to the set textbook.

Great idea, but complex and hard to get onto the computer.

Fairly simple to use.

It has been a delight.

Top stuff.

Shouldn't let it replace other types of assessment.

Yes, it is much more interesting working with the computers.

Should be used for all EC110, but shouldn't replace tutorials. Tutorials should be brought back if possible.

It should be used throughout the course, as it is a great aid (to learning) - except when the computer mucks up.

A weekly computer test would be too much, but perhaps fortnightly tests would be appropriate.

I think it would be a great idea to introduce revision programs, or summaries that we can use, as well as the weekly tests.

Good for revision (CML) if you could get out more tests.

Good idea, should be able to draw other non-compulsory tests to use for revision.

The idea of being able to get marks toward your (end of year) assessment was great and encouraging.

APPENDIX B

How about printing out the correct answers instead of just displaying them on the screen?

Wastes a lot of paper - think of the poor little trees.

Issue out answers and reasons for the answer on completion of the test.

Its good, but not for the entire course because anybody can get full marks with a book by their side.

A printout of your score - indicating wrong answers - would be helpful. A monitor to help with minor computer operation problems would be helpful.

It would be best for students to have some experience of computers before they use CML.

High speed printers will be more advantageous.

I liked working with the computers and it was a new experience. I think more Departments should use computer-based testing.

Paper waste.

Other courses should use this approach.

It was beneficial to our learning and understanding of economics.

Very interesting and I've learnt something new.

CML would have been better if course material was included (on the computer) i.e. like the CAI in other subjects.

Really easy (to use), fast; it was really good overall.

Let's put some excitement into it - cut (reduce) the true/false, multiple choice questions.

If there was less wastage of paper in the printers I think it would be more favourable.

A test per week would be too much to handle - a smaller number of tests - say six per semester - would be more suitable. Current weekly (tutor marked) tests are pretty much a waste of time.

Needed a few more instructors and more printers.

It could have been made a little more difficult with more analytic commands required.

Good learning process. Good practical problem solving experience.

Good, but doesn't really sort out the students, only the lazy from the competent.

Continue it.

Added a bit of excitement to the course - great idea.

There were no instructions on what to do if the printer ran out of paper.

Perhaps the computer room could be open longer hours.

I enjoyed it.

Staff were very helpful (tutors and computer room supervisor).

APPENDIX B

It would have been better if people who hadn't used computer before had a short familiarisation (e.g. 15 mins) with them.

Good way of introducing computers and stressing important points made in lectures.

Great assistance from computer room supervisor.

Keep it going.

Helped you to know what you understand and what you need to know further by practical questions.

It would be good if students could have more tests (non assessed) for revision.

The actual system was fine but I was unclear about the actual assessment allocation in regards to the exams etc.

I have no background in economics, when learning the subject I had a number of problems but this approach helped a lot.

Issuing of tests was a little wasteful on paper.

Very good idea as it helps with revision. It would have been helpful also in the earlier part of the macro EC110 course to provide examples. Probably more useful in macro than micro economics.

More of it.

It is easy to work with.

Apart from the procedures of getting onto the system, its been perfect.

More refinement needed in the random selection of questions to ensure all topics are covered in tests.

Would have liked to been able to re-display answers on screen to tests just completed.

Supervisor - great to have them available so often.

I had a problem entering information in the form acceptable to the computer.

Not very well initially explained.

It is better than weekly tests.

The introductory lecture regarding how to use the CML system was obscure.

It would help if explained why the answers were wrong rather than just give us the correct answer.

It made application of material and learning more useful. It gave feedback on progress.

It was a lot better than other forms of written assignments.

I liked the "congratulations you have passed" printed on the screen.

More assistance in the computer room.

Its something different, a change to other boring learning methods.

I was nervous about using it at first, but after the first time it was easy (to use) and I was OK.

It was foreign to me. We were thrown straight in, we should have had practices and explained in more detail so we could learn to use it gradually.

A great advantage was the fact of time - able to do it when you liked, plus availability of help when needed.

A very good alternative to tutorials. Very satisfactory.

Maybe we should have been able to draw "dummy" tests for revision.

Overall it seemed a useful exercise and allowed a little extra time (for part-timers) to do extra assessment.

It taught me a bit about computers, and gave me confidence in a new area that I'm sure to encounter again.

Very easy to sign on. I like to have access during "non-business" hours as I have a full-time job and other commitments.

Unfriendly. I would rather learn and be tested by people rather than computers.

It was clearly set out and easy to understand. Immediate feedback was good.

Computers aren't always reliable.

Answers should be shown in greater detail. Supervisor was very helpful.

An immense waste of valuable paper.

The computer room should be open until at least midnight.

Liked the report issued at the end of marked tests.

For an initial use (implementation) of the system it was very successful - top marks.

It would be an advantage if students were allowed to draw more trial exams, to give greater experience.

I enjoyed the experience of answering the tests and it motivated me to answer the following tests.

The explanation in the first lecture could be improved.

I was lucky that I didn't have any problems, but I have heard of quite a few people who did.

It would be good if we could get out more tests.

Excellent idea for part-time students with limited time.

It needs to be well backed up with computer staff to handle difficulties, and tutors need to be given as much time as possible to answer enquiries.

I think it would be better to give students a printed explanation of the system requirements - I got very confused.

Only that its more time consuming to gain access to the computers rather than doing a test in class, but obviously easier for the lecturer/tutor etc.

Lets you work at own pace. The results of your work could be seen immediately when it was marked. Good stuff.

Maybe not such a high pass mark?

Computer room too packed at times.

None apart from need for greater feedback on incorrect answers.

Difficult for part-time students to get time to gain access.

Easy to operate - required no experience.

More hands on.

Should be instituted immediately.

Gives more enthusiasm to study, and study is more easily retained. Also, shows us where we are going wrong; free of pressure.

Very good the way it (computer) automatically knows where you are up to and follows on accordingly.

It would have been better if it could give you explanations as to where you went wrong.

Would have been better if used throughout the year in place of tutorial exams. Also, would be advantageous if we could draw further tests for revision that could be marked but not for assessment - especially just before exams.

Great, and very versatile and fair to all.

Only that it was much better than the other type of weekly tests we had.

Needless and cumbersome - took up too much time that could have been better spent elsewhere.

Should receive more feedback about questions answered wrongly - hints/explanations.

Need another printer.

QUESTION 8

What is your verdict on the CML System? Should the Department proceed with this system?

Yes = 465
No = 17

QUESTION 9

Would you like to have more control over the CML System? (e.g. drawing tests whenever you liked; proceeding through the course as fast as you liked).

Yes = 352
No = 83

QUESTION 10

Would you please tell me something about yourself?

Degree enrolled for B.Ec. = 89
B.Comm. = 238
B.A. (+ Other) = 126

Year of First Enrolment at the University of Queensland

1986 = 325
1985 = 47
1984 = 18
1983 = 13
1982 = 6
1981 = 6
1980 = 5
Other = 5
No answer = 25

Gender: Male = 260
Female = 190

Enrolment: Full-time = 399
Part-time = 55

QUESTION 11

Any Other Comments:

No = 327
Yes = 126

The complexity of EC110 is made easier via the use of CML. Surely this is the direction of future educational institutions.

Better training would lead to greater understanding and less confusion.

EC134 would have to be one of the worst subjects at Uni, what can be done about it?

I think that the 1st semester tests (tutor marked) should be handed back to the students so that we can correct our mistakes before we make the same mistakes in the final exam.

I feel that for the objectives to be of more use they should be more specific.

I found on completion of a module I had a far better understanding of the work covered.

Weekly tests in lectures were of no benefit and caused more worry than anything else!

This is a good way to see how much you understand and to help you with learning. Able to test yourself/knowledge.

More training needed in computers generally - not so much CML.

The CML (system) is a more practical alternative than the 500 word essays used in Semester 1.

Should be able to get as many tests on each area as you wish. Should be a major form of assessment for the whole year.

I have found EC110 not practical enough for my degree.

Give deadline for tests to be due!

Found it very helpful.

I hope any ambiguity (questions) will be cleared up for the end of year papers!

Microeconomics exam should have been conducted at the end of first semester - there is far too much material to wade through to study if they are both held at end of year.

Should have thought of it earlier because tests held earlier in the course were hopeless.

Could be better if used computers for more than little exams e.g. for substantial assessment.

I've enjoyed this part of the course more than the others!

We should use it (CML system) for the end of year exam.

Great system, needs more questions with different information to make tests more of an exam - its too easy to cheat and not learn anything.

I loved it.

I wish we could of had them (computer tests) for the full duration of the course.

The items on the (student) menu which we were not able to use should have been deleted as they confused many students.

I'm glad the CML system was brought in, otherwise I would leave everything until swat vac.

CML system would be more useful and less frustrating if questions given referred to the appropriate section of the textbook.

The (weekly) supervised tests I found to be of little help in understanding the course; however, I learnt a great deal from the computer tests.

I hated 1st semester of EC110.

Software is good, not so sure about hardware - need more printers.

Didn't have to spend too much time at the computer.

System not yet perfect - some "refining" needed.

Overall CML was a very efficient system. Time limits (e.g. 2 weeks) should be set for the completion of tests.

Does not sort out students (anybody can get full marks with a book at their side) or provide a spread of marks.

Analysis of sample test questions with lecturer/tutors would be extremely beneficial.

The system is good but some questions are a little too ambiguous. On the whole I thoroughly approve of it.

Proceed with CML. It is very easy to use, and as long as the printers are working, quick.

Bit of a pain having the tutors come to the class tests, would have been better to have times when they would be available - i.e. non-compulsory tutorials - and have CML tests.

Should have thought about this last year so we could have had it (CML) for the entire year.

I wish we could draw sample tests that are not marked for assessment, to get some idea of the subject before drawing formal tests.

Hope we use CML for other Economics courses.

I like the CML approach.

I think that all tests should be available at all times.

CML has provided 2nd semester EC110 with easily obtainable results and constructive learning activities. Good idea.

Keep the CML system and spread it around - don't hog it!

Have a lot of test questions now (i.e. as examples); appreciate the CML facility of providing test to be completed in your own time.

Should have started CML system at the beginning of the year - EC110 would not have been such a drudgery then.

The pass percentages are too high.

The lecturers/supervisors were very helpful in answering questions.

System should be more closely aligned with the text and other cource material - perhaps tests could include references to the textbook.

More programming by students.

Should have as much use of computers as possible since we'll need to know how to use them when we begin work.

I think it is a good idea.

Could be improved by allowing tests to be drawn at any time and providing an unlimited number of tests.

It's great.

Well done Economics Dept.!

System could be improved in some way maybe, but as a first try it was very good.

Thanks.

Very effective form of assessment.

Didn't really like last semester's (semester 1) EC110.

This part of the course was fun.

Should be developed as much as possible.

Good.

Good - keep CML here in this subject and maybe add it to others.

Tutors should be available at the computer room to answer student queries/explain wrong answers.

Good, and I prefer assignments in that fashion as general essay type assignments (e.g. microeconomics) are not fair or representative of the real ability of the student.

Computer room supervisor was very helpful.

It was good, but should be kept as only part of the course, although the weighting could be increased perhaps.

This was my first economics subject and I had lots of problems. CML organised my learning program and with the knowledge I acquired it (CML) helped me to relate to the questions being asked.

Tutorials should be provided, mere access to tutors is not enough help. Microeconomics section in particular would benefit from tutors and explanations.

Lecturer and computer room supervisor have been of great help in assisting the students.

The section on macroeconomics was a vast improvement on the earlier microeconomics section - to a large extent it is interesting and relevant.

Throw a bucket of salty water over the damn thing (computer).

Effective way to study.

I am very interested in this type of computer based learning and have some experience in this field.

System, while good once you get the hand of it, is much more difficult for part-time students due to time consumed. Some formal tutorial back-up would help.

CML makes up for any failings in the tutors. Unfortunately people did seem to "lose" tests in the system prior to printing though.

Please avoid class tests as used in the first part of EC110, as they do nothing to increase one's grasp of the subject.

Good idea.

CML helps you to learn practical questions for (end of year) exam.

Excellent idea.

People who know others capable of using it would gain better results (e.g. cheating). It wasn't fair. Assignments are peoples own work and harder to cheat from. Those by themselves don't know how it works - find it difficult - won't ask i.e. there is an unfair advantage especially for full-time kids.

This system should be used for all multi-choice exams at University.

EC110 is an elective with me, I've done English majors and am not very good at maths.

For part-time students is not available on weekends - this is the time I do most (almost all) of my studying.

The entire subject working in conjunction with properly ordered tutorials at assigned times would have been most beneficial.

Continue testing in this fashion.

Its progressive.

Keep the structure of the computer section as clear as possible - it was simple, but some people of lesser intellect were confused by the presentation.

CML system was an innovative and better way of sitting for exams.

If the printers could somehow be protected from people playing around with the buttons on them, it would save a lot of hassles.

It needs to be improved in area of correct answers, no system for 1/2 right, 3/4 right, etc.

Should make sure we know something about computers before you dump computer based assessment on us.

It was easy to operate and made me learn more of the course.

Tutorial system needs drastic change - having tutorial after night lectures (i.e. 3 hours straight) is ridiculous (especially when you start the day at 9 a.m.). As a result I never ever stayed although I needed help.

EC110 should be divided into two separate semesters - tested each semester : no justification for whole year subject.

Very helpful for revision and (practice at) end of year type questions.

The assistance of CML system supervisor was much appreciated. I also feel EC110 should be split into two semesters e.g. micro and macro.

All students should be able to take a supplementary test for a Grade 3 pass, especially Arts students.

A very helpful system - very much appreciated.

The computer assessment was more exciting than other forms of assessment and much faster and efficient.

You've got a great idea here - it just needs a little more work to get rid of the bugs.

The supervisor of the CML system was easily approachable and helpful.

Allows one to learn at own pace. Encourages further referral to other material. Aids in retention of answers as well as other related concepts.

EC110 is an introductory economics course, not an introductory computer subject.

Systems good, should be kept.

Difficult for part-time students to arrange to use.

A must for part-time students. What about our other tests and assignments?

For someone not familiar with the system, it must have been very difficult. As a part-time student I found guidance and help difficult to come by.

Tutorial system needs drastic change - e.g. go back to formal tests and get decent tutors who are prepared to spend the time.

As a general comment, I find the replacement of scheduled tutorials with weekly tests as seriously deleterious to the academic standards of this Economics course.

Proceed with the system for first years only as it gives incentive for own research.

Someone should be available at all times for computer errors and general help.

Some short summary of course material in addition to the current options would be an advantage.

I do not support EC110 being a whole year course. There is too much revision to make a good go of it. Break up micro and macro.

It would be great if we could have used the review facility on the computer.

Scrap little 2.5% exams; they are a waste of time and resources.

Thank you for providing this facility for learning.

I think that tutorial contact is still very important and that has been the greatest disadvantage of the entire EC110 subject.

The course needs formal tutorials.

I don't think that the system should be used to replace tutors etc. Most people need to learn on a person to person basis.

Multiple choice questions that can be answered at your leisure are too easy to fulfill. A significant portion of the subject assessment.

Thanks. I was concerned at first but it was easy, simple and enjoyable to use. Some of the questions were a little ambiguous though. It would have been handy to have someone in the computer room on the first test though, after test 1 it was okay.

Make tutorials meaningful. Results to tutorial tests would be appreciated, especially if I knew where I was going wrong. The course is great except for the non-meaningful tutorials.

When it gives you the answer it should show how they got it or explain it in greater detail, otherwsie CML is great.

There should be an explanation available for the questions so that if you are wrong you can immediately find out why.

APPENDIX C

EXAMPLES OF SELECTED CML REPORTS

Items:

1. Error Check on Testbank Questions
2. Distribution of Questions in Testbank
3. Summary of Testbank Contents
4. Statement of Module and Objective Titles
5. Summary of Student Marks Per Module (Highest Score in each Module has been Selected)
6. Class Progress - Listed in Order Modules Completed (Listed by Student Name)
7. Class Progress - Listed in Order of Modules Completed (Listed by Student I.D.)
8. Student Records

APPENDIX C. Item 1

```
                                                                      Page  :
Report: 2.4                    Testbank.Check                    20-NOV-198
                             for Testbank JS2

                                ** Legend **

                  W - Warning, will not affect use of testbank
                  * - Sequence Error, must be corrected
                 ** - Question Coding Error, must be corrected
---------------------------------------------------------------------------
Module  1

   Objective  1-1  No Errors Found

   Objective  1-2  No Errors Found

   Objective  1-3  No Errors Found

   Objective  1-4  No Errors Found

   Objective  1-5  No Errors Found

   Objective  1-6  No Errors Found
---------------------------------------------------------------------------
Module  2

   Objective  2-1  No Errors Found

   Objective  2-2  No Errors Found

   Objective  2-3  No Errors Found
---------------------------------------------------------------------------
Module  3

   Objective  3-1  No Errors Found

   Objective  3-2  No Errors Found

   Objective  3-3  No Errors Found

   Objective  3-4  No Errors Found

   Objective  3-5  No Errors Found

   Objective  3-6  No Errors Found
```

[The "Testbank Check" function provides an error check on the testbank questions (by module and objective) to identify syntax errors in question coding. This function does not, however, identify errors relating to random variables or involving algebraic expressions in problem solving type questions].

APPENDIX C, Item 2

```
Report: 2.6.2                  Testbank.Characteristics.Distribution          Page   1
                                     for Testbank JS2                       20-NOV-1986

                                    Lock Masks                            Question Types
                    01    02    04    08    16    32    64          1     2     3     5     9

Module  1

 Objective 1        64     6     0     0     0     0     0          0    70     0     0     0
 Objective 2        25     4     0     0     0     0     0         18    11     0     0     0
 Objective 3        26     4     0     0     0     0     0          0    30     0     0     0
 Objective 4        32     4     0     0     0     0     0          0    20     8     8     0
 Objective 5        11     3     0     0     0     0     0          0    10     0     4     0
 Objective 6        12     3     3     0     0     0     0          0     5     4     9     0
                    --    --    --    --    --    --    --         --    --    --    --    --
                   170    24     3     0     0     0     0         18   146    12    21     0
 Total 197


Module  2

 Objective 1        41     0     0     0     0     0     0          0    41     0     0     0
 Objective 2        25     0     0     0     0     0     0          1    24     0     0     0
 Objective 3         8     1     0     0     0     0     0          0     0     3     6     0
                    --    --    --    --    --    --    --         --    --    --    --    --
                    74     1     0     0     0     0     0          1    65     3     6     0
 Total  75

Module  3

 Objective 1        10     0     0     0     0     0     0          0    10     0     0     0
 Objective 2        23     0     0     0     0     0     0          8    15     0     0     0
 Objective 3        19     0     0     0     0     0     0         19     0     0     0     0
 Objective 4        22     2     0     0     0     0     0          0     0     7    17     0
 Objective 5        25     2     0     0     0     0     0         13    10     4     0     0
 Objective 6        10     0     0     0     0     0     0          0    10     0     0     0
                    --    --    --    --    --    --    --         --    --    --    --    --
                   109     4     0     0     0     0     0         40    45    11    17     0
 Total 113

     Totals        353    29     3     0     0     0     0         59   256    26    44     0

  Grand Total      385        Question Type Percentage        15.3  66.5   6.8  11.4   0.0

                                                                         Press <Return>
```

[This report provides an overview on the questions in the testbank. Information is in two forms:-
(a) the number of questions in each "Lock Mask" (i.e. sub group), and
(b) by "Question Types" (e.g. type 1 = multiple choice, type 2 = true/false, etc.]

APPENDIX C, Item 3

```
                                                                        Page   1
Report: 2.7.2                Testbank.Document.Catalog                20-NOV-198
                               for Testbank JS2

    MR JON STANFORD
    ECONOMICS DEPT., UNIVERSITY OF QUEENSLAND
    CREATED FOR COURSE EC 110 MACRO , SEMESTER TWO 1986
    (OBK JS2), 3 Modules.
           (THE 3 MODULES IN THIS QUESTION BANK WERE CREATED
            FROM OBK JS1 AS FOLLOWS;
                  MODULE 1 = MODULES 1 TO 6 IN JS1
                  MODULE 2 = MODULES 7 & 8 IN JS1
                  MODULE 3 = MODULES 9 TO 14 IN JS1 )


                              3     MODULES
                              3     MODULE STATEMENTS
                             15     OBJECTIVES
                             15     OBJECTIVE STATEMENTS
                            385     QUESTIONS

                        59     Multiple Choice (1)     15.3%
                       256     True - False    (2)     66.5%
                        26     Short Answer    (3)      6.8%
                        44     Problem Solving (5)     11.4%




                                                                 Press <Return>
```

Report: 2.7.2 Testbank.Document.Catalog Page 1
for Testbank JS2 20-NOV-1986

Module 1: THE OPEN ECONOMY AND THE BALANCE OF PAYMENTS

Objective

1. RECOGNISE CONCEPTS OPEN ECONOMY
2. IDENTIFY REASONS FOR TRADE
3. RECOGNISE CONCEPTS OF BALANCE OF PAYMENTS
4. IDENTIFY CURRENT ACCOUNT OF BALANCE OF PAYMENTS
5. IDENTIFY CAPITAL ACCOUNT OF BALANCE OF PAYMENTS
6. CALCULATE "BASIC BALANCES" FOR BALANCE OF PAYMENTS

Module 2: FOREIGN EXCHANGE MARKET

Objective

1. RECOGNISE CONCEPTS OF FOREX MARKET
2. RECOGNISE THEORIES OF FOREX MARKET
3. CALCULATE SPECIFIC FOREIGN EXCHANGE DEALS

Module 3: MONEY, BANKING, AGGREGATE DEMAND AND SUPPLY

Objective

1. IDENTIFY AGGREGATE DEMAND AND SUPPLY IN OPEN MARKET
2. RECOGNISE ROLE OF MONEY, FUNCTIONS OF MONEY
3. RECOGNISE CAPITAL MARKET, ROLE OF MAJOR INSTITUTIONS
4. CALCULATE MEASURES OF MONEY SUPPLY AND MONETARY AGGREGATES
5. RECOGNISE MONETARY POLICY MEASURES
6. RECOGNISE MONEY AND AGGREGATE DEMAND

```
                                Analysis.Grades.Summary                           Page   1
Report: 5.6.3            for Course EC110A        Subject ECONOMIC              20-NOV-1986
                                                  --------------------------------------------
---------------------------------------------
                                       | EXAMS          1          2          3        FINAL
                                       |
STUDENT NAME                ID         |
--------------------------------------------------------------------------------------------
                          000528       |                94         97        100       97.00
                          001955       |                75         87         92       84.67
                          002090       |                82         97         90       89.67
                          002438       |                84         97         95       92.00
                          003095       |                90        100        100       96.67
                          003742       |                88        100         93       93.67
                          763061       |                84        100        100       94.67
                          004623       |                84         93         97       91.33
                          004912       |                94         90         86       90.00
                          005932       |                88         93        100       93.67
                          007072       |                67         92         83       80.67
                          007120       |                84         97         85       88.67
                          007692       |                82        100         86       89.33
                          007914       |                91         91         88       90.00
   STUDENT                008077       |                97         92         88       92.33
    NAMES                 008958       |                76         86         78       80.00
   REMOVED                010183       |                85         97         97       93.00
                          010462       |                96         94         91       93.67
                          010564       |                91         89         90       90.00
                          011335       |                91         97         97       95.00
                          012235       |                93        100         91       94.67
                          012820       |                78        100         92       90.00
                          013589       |                79         93        100       90.67
                          011999       |                87        100         97       94.67
                          015904       |                98         96         89       94.33
                          016465       |                 0          0          0        0.00
                          017024       |                83         95        100       92.67
                          018082       |                85         62          0       49.00
                          018130       |                89        100         85       91.33
                          015276       |                93         97         89       93.00
                          020198       |                92        100         95       95.67
                          020639       |                96         92        100       96.00
                          020872       |                93         86        100       93.00
                          017979       |                95          0          0       31.67
                          022762       |                81         93         79       84.33
                          023098       |                94         89         97       93.33
                          023521       |                79         94         73       82.00
                          025069       |                75        100         74       83.00
                          016573       |                76        100         90       88.67

                                                                  Press <Return>
```

[This report indicates a students highest score in each of the three module tests, irrespective of which attempt the student achieved this score].

APPENDIX C. Item 6

```
Report: 5.2                     Analysis.Progress                          Page
                      for Course EC110A       Subject ECONOMIC          20-NOV-198

          LEGEND:   L = LAST MODULE   860921
                    C = CURRENT MODULE    861120
                    S = SAME MODULE BOTH DATES
                    P = MODULE PASSED
                    I = INSTRUCTOR SET CONDITIONAL PASS
                    X = ATTEMPTED BUT NOT PASSED
                    ! = CURRENT CLASS AVERAGE

    NAME                         MODULES OVER          60 DAYS

                                        E
                                  0 0 0 0
                                  1 2 3 1
                                ***********
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
                                * P P P C
   STUDENT
    NAMES                          |
   REMOVED                         |
                                   ↓
                                * P P P C
                                * P P P C
                                * I P P C
                                * P P P C
                                * P P P C
                                * I P C
                                * P P C
                                * P P C
                                * P P C
                                * P P C
                                   |
                                   |
                                   ↓
                                * P P C
                                * P P C
                                * P P C
                                * P P C
                                * I C !
                                * P C !
                                * P C !
                                * P C !
                                * I C !
                                * P C !
```

[This "Progress Report" lists all students alphabetically in order of the number of modules they have completed, e.g. all students that completed Modules 1 to 3 are listed first, then all students that completed modules 1 and 2, etc]

APPENDIX C. Item 7

```
Report: 5.2                    Analysis.Progress                        Page  1
                        for Course EC1108       Subject ECONOMIC        20-NOV-198

          LEGEND:   L = LAST MODULE    860822
                    C = CURRENT MODULE    861120
                    S = SAME MODULE BOTH DATES
                    P = MODULE PASSED
                    I = INSTRUCTOR SET CONDITIONAL PASS
                    X = ATTEMPTED BUT NOT PASSED
                    ! = CURRENT CLASS AVERAGE

   ID                            MODULES OVER          90 DAYS

                          E
                    0 0 0 0
                    1 2 3 1
                  ***********
000244            * P P P C
001902            * P P P C
004622            * P P P C
005747            * P P P C
006855            * P P P C
008562            * P P P C
014449            * P P P C
014079            * P P P C
014952            * I P P C
017792            * P P P C
017971            * P P P C
021037            * P P P C
023377            * P P P C
027602            * P P P C
  |                   |
  |                   |
  ↓                   ↓
130321            * P P P C
166309            * P P P C
166519            * P P P C
168151            * P P P C
174769            * P P P C
176008            * P P P C
181312            * P P P C
182893            * P P P C
182964            * P P P C
183146            * P P P C
000203            * P P C
019748            * I P C
034189            * P P C
044184            * P P C
054658            * P P C
087053            * P P C
112227            * P P C
124007            * P P C
138319            * P P C
161916            * P P C
167952            * P P C
  |                   |
  |                   |
  ↓                   ↓
.023448           * I C !
029374            * I C !
042604            * I C !
041632            * I C !
039621            * I C !
035813            * I C !
047403            * I C !
```

[This "Progress Report" is similar to Appendix C, Item 6 except that student ID's are used in place of student names].

APPENDIX C. Item 8

```
Report: 5.3                        Analysis.Modules                              Page
                        for Course EC110A       Subject ECONOMIC          20-NOV-1986

Student name :  **
Student ID   : 000528

Mods/   Starting          Completion    Attempts          S C O R E S
Tests   Date/Time         Date/Time   Pass  Total   1     2     3     4   Last

  1   860923 17:35   861007 09:21   1P     1   94     0     0     0     0
  2   861007 09:23   861021 09:24   1      1   97     0     0     0     0
  3   861021 09:24   861030 13:49   2      2   83   100     0     0     0

Student name :  **
Student ID   : 001955

Mods/   Starting          Completion    Attempts          S C O R E S
Tests   Date/Time         Date/Time   Pass  Total   1     2     3     4   Last

  1   860924 13:06   861013 08:36   3P     3   52    69    75     0     0
  2   861013 08:39   861015 11:33   1      1   87     0     0     0     0
  3   861015 11:34   861023 09:28   3      3   69    63    92     0     0

                 **
Student name :
Student ID   : 002090

Mods/   Starting          Completion    Attempts          S C O R E S
Tests   Date/Time         Date/Time   Pass  Total   1     2     3     4   Last

  1   860929 13:31   861003 13:47   2      2   11    82     0     0     0
  2   861009 20:04   861016 21:09   1      1   97     0     0     0     0
  3   861016 21:11   861024 14:21   2      2   35    90     0     0     0

Student name :  **
Student ID   : 002439

Mods/   Starting          Completion    Attempts          S C O R E S
Tests   Date/Time         Date/Time   Pass  Total   1     2     3     4   Last

  1   861001 12:26   861005 11:49   1      1   84     0     0     0     0
  2   861007 10:50   861008 20:42   1      1   97     0     0     0     0
  3   861014 10:54   861024 10:59   1      1   95     0     0     0     0

Student name :  **
Student ID   : 003095

Mods/   Starting          Completion    Attempts          S C O R E S
Tests   Date/Time         Date/Time   Pass  Total   1     2     3     4   Last

  1   861001 10:45   861002 09:47   1      1   90     0     0     0     0
  2   861007 13:01   861008 13:07   1      1  100     0     0     0     0
  3   861014 13:54   861017 13:59   2      2   82   100     0     0     0
```

** STUDENT NAMES REMOVED

APPENDIX D

EXAMPLES OF SELECTED CML ANALYSIS OPTIONS

Items:

1. Analysis of Objective Performance Per Type of Question
2. Analysis of Multiple Choice Question Performance
3. Analysis of True/False Question Performance
4. Analysis of Completion (& Matching) Question Performance
5. Analysis of Self Generating (Calculation) Question Performance

APPENDIX D, Item 1

```
Report: 5.4                    Analysis.Objectives                        Page
                               for Testbank JG2                    20-NOV-198

                          OBJECTIVE/QUESTION SUPPORT

                           TYPE  1    TYPE  2    TYPE  3    TYPE  5    AVERAGE  PROBLEMS
                           * <  30    * <  45    * <  25    * <  25

MODULE  1 OBJECTIVE 1          0         73          0          0         73
          OBJECTIVE 2         52         79          0          0         62
          OBJECTIVE 3          0         80          0          0         80
          OBJECTIVE 4          0         69         39         38         55
          OBJECTIVE 5          0         75          0         20         59        *
          OBJECTIVE 6          0         67          0         64         50        *

MODULE  2 OBJECTIVE 1          0         79          0          0         79
          OBJECTIVE 2         57         80          0          0         79
          OBJECTIVE 3          0          0         62         69         69

MODULE  3 OBJECTIVE 1          0         71          0          0         71
          OBJECTIVE 2         69         77          0          0         74
          OBJECTIVE 3         70          0          0          0         70
          OBJECTIVE 4          0          0         81         47         57
          OBJECTIVE 5         66         84         35          0         68
          OBJECTIVE 6          0         78          0          0         78


                                                                    Press <Return>
```

[This report provides analysis on the performance of modules by objective for each of the different question "Types" (Type 1 = multiple choice, Type 2 = True/False, Type 3 = Matching/Completion, Type 5 = Problem Solving). Low Cut-off identifiers have been selected for each of the question "Types" (e.g.< 30, etc.), if the questions in the objective perform below this level then a "Problem" is identified in Problems Column as *].

```
Report: 5.5.1.1  Analysis.Questions.Multiple_Choice.Detailed          Page  1
                          for Testbank JS2                        20-NOV-198

MMOQQ-A LL #ISSUED    1     2     3     4     5     6  %CORRECT < 35    35 - 85  > 85

 1212 F  1      68    3     1    19   33*   12     0      48               *
 1212 N  1      31    3     1     6   14*    7     0      45               *
 1213 F  1      64    6    13     2   43*    0     0      67               *
 1213 N  1      30    0    11     1   15*    3     0      50               *
 1213 S  1       1    1     0     0    0*    0     0       0       *
 1214 F  1      64    4   45*     3    2    10     0      70               *
 1214 N  1      30    1   17*     0    3     8     1      56               *
 1215 F  1      69    0    11     3   47*    8     0      68               *
 1215 N  1      31    2     2     1   16*   10     0      51               *
 1216 F  1      77  57*     2     5    1    11     1      74               *
 1216 N  1      30  18*     2     2    1     7     0      60               *
 1217 F  1      60    0     0     3   51     6*    0      10       *
 1217 N  1      40    2     0     0   29     9*    0      22       *
 1218 F  1      73    2    23   39*    0     2     7      53               *
 1218 N  1      30    2     7   19*    0     0     2      63               *
 1219 F  1      57   43     0     6    0     8*    0      14       *
 1219 N  1      41   26     1     6    1     7*    0      17       *
 1220 F  1      72  45*     4    18    3     1     1      62               *
 1220 N  1      43  36*     3     0    3     0     1      83               *
 1221 F  1      76  63*     3     6    4     0     0      82               *
 1221 N  1      36  28*     3     1    3     1     0      77               *
 1222 F  1      76    2   48*     2   23     1     0      63               *
 1222 N  1      43    1   27*     3   12     0     0      62               *
 1223 F  1      73  58*     6     1    7     0     1      79               *
 1223 N  1      30  21*     7     0    1     1     0      70               *
 1224 S  2       2    1     0     0    1*    0     0      50               *
 1225 F  1      67    3    17     4   42*    0     1      62               *
 1225 N  1      28    0     8     0   19*    1     0      67               *
 1226 N  2       1   1*     0     0    0     0     0     100                       *
 1226 S  2       1   0*     1     0    0     0     0       0       *
 1227 F  1      59    6     0   29*    6    18     0      49               *
 1227 N  1      27    4     0   14*    3     6     0      51               *
 1228 F  1      67   16   22*     0    8    21     0      32       *
 1228 N  1      36    8   11*     2    6     9     0      30       *
 1229 F  1      62   14    20   15*   12     0     1      24       *
 1229 N  1      32    8     7    9*    3     3     2      28       *
```

[This report provides analysis on the performance of the multiple choice questions in the testbank. The number of times each question was issued and the alternative answer options selected by students are recorded. Questions performing below or above selected values (e.g. 35% and 85%) are identified by * in the last and third last columns].

```
Report: 5.5.2           Analysis.Questions.True/False                  Page   1
                           for Testbank JS2                         20-NOV-199

  MMOOQ TT LL  #ISSUED     1ST        SUB        SUP          CATEGORIES
                          # / %      # / %      # / %    < 45   45- 90   > 90

   1101  2  1       22    16/ 68      6/ 66     0/  0              **
   1102  2  1       42    25/ 96     17/100     0/  0                      **
   1103  2  1       30    22/100      8/100     0/  0                      **
   1104  2  1       36    27/ 74      9/100     0/  0              *       *
   1105  2  1       24    15/ 33      9/ 55     0/  0      *       *
   1106  2  1       37    25/100     12/100     0/  0                      **
   1107  2  2        1     0/  0      0/  0     1/100                      *
   1108  2  1       42    26/ 92     16/100     0/  0                      **
   1109  2  1       35    27/ 70      8/ 87     0/  0              **
   1110  2  1       49    32/ 87     15/ 80     2/ 50              ***
   1111  2  1       38    27/ 92     11/100     0/  0                      **
   1112  2  1       47    29/ 89     18/ 94     0/  0              *       *
   1113  2  1       48    39/ 71      9/ 66     0/  0              **
   1114  2  1       22    14/ 57      8/ 87     0/  0              **
   1115  2  1       42    30/100     12/100     0/  0                      **
   1116  2  1       33    22/ 95     11/100     0/  0                      **
   1117  2  1       39    30/ 96      9/ 88     0/  0              *       *
   1118  2  1       46    29/ 48     17/ 41     0/  0      *       *
   1119  2  2        1     0/  0      0/  0     1/  0      *
   1120  2  1       38    24/100     14/ 92     0/  0                      **
   1121  2  1       50    35/ 94     15/ 86     0/  0              *       *
   1122  2  1       31    17/ 64     12/ 83     2/  0      *       **
   1123  2  1       35    18/100     17/100     0/  0                      **
   1124  2  1       49    31/ 96     18/ 88     0/  0              *       *
   1125  2  2        1     0/  0      0/  0     1/  0      *
   1126  2  1       28    19/ 42      9/ 88     0/  0      *       *
   1127  2  1       44    32/100     12/100     0/  0                      **
   1128  2  1       42    30/ 93     12/ 91     0/  0                      **
   1129  2  1       45    33/ 93     12/100     0/  0                      **
   1130  2  1       48    31/ 48     17/ 35     0/  0      *       *
   1131  2  1       36    22/100     14/ 85     0/  0              *       *
   1132  2  1       57    35/ 22     22/ 31     0/  0      **
   1133  2  1       46    32/ 93     14/100     0/  0                      **
   1134  2  1       39    26/100     13/ 84     0/  0              *       *
   1135  2  1       42    36/ 83      6/100     0/  0              *       *
   1136  2  1       43    30/ 60     13/ 53     0/  0              **
   1137  2  1       32    19/ 94     13/100     0/  0                      **
   1138  2  1       43    29/ 65     14/ 73     0/  0              **
   1139  2  1       45    27/ 74     18/ 61     0/  0              **
   1140  2  1       38    24/ 54     14/ 57     0/  0              **
   1141  2  1       41    27/ 92     14/ 78     0/  0              *       *
   1142  2  1       35    22/ 81     13/ 76     0/  0              **

                                                              Press <Return>
```

[This report provides analysis on the performance of the True/False questions in the testbank. Question performance is identified for first attempts at a test, and subsequent attempts at a test or supervised tests - and corresponding problems identified by * in the last and third last columns].

APPENDIX D. Item 4

```
                                                                          Page   1
Report: 5.5.3              Analysis.Questions.Completion               20-NOV-1986
                              for Testbank JS2

                                                                  CATEGORIES
                             1ST        SUB        SUP         < 30   30- 85   > 85
MMOOO TT LL  #ISSUED        # / %      # / %      # / %

1411   3  1      79        62/ 27     16/ 31     0/  0        *       *
1412   3  1      73        52/ 46     21/ 61     0/  0                **
1413   3  2       2         2/  0      0/  0     0/  0        *
1414   3  1      76        49/ 73     27/ 88     0/  0                *        *
1415   3  1      82        57/ 40     25/ 52     0/  0                **
1416   3  1      67        44/ 11     23/ 13     0/  0        **
1417   3  1      84        60/ 60     24/ 58     0/  0                **
1418   3  1      81        52/ 44     29/ 51     0/  0                **

1601   3  4       2         2/  0      0/  0     0/  0        *
1602   3  4       4         2/  0      2/  0     0/  0        **
1603   3  4       6         3/  0      3/  0     0/  0        **
1604   3  2       5         1/  0      0/  0     4/  0        **

2303   3  1     334       188/ 67    146/ 74     0/  0                **
2304   3  1     334       205/ 60    129/ 79     0/  0                **
2305   3  2

3418   3  1     113        60/ 75     53/ 90     0/  0                *        *
3419   3  1     123        57/ 70     66/ 96     0/  0                *        *
3420   3  1      97        49/ 77     48/ 91     0/  0                *        *
3421   3  1     102        56/ 78     46/ 89     0/  0                *        *
3422   3  1      91        53/ 73     38/ 86     0/  0                *        *
3423   3  1      87        43/ 81     44/ 88     0/  0                *        *
3424   3  1     100        54/ 75     46/ 82     0/  0                **

3514   3  1     112        50/ 52     62/ 59     0/  0                **
3515   3  1      97        50/ 14     47/ 14     0/  0        **
3519   3  1      97        52/ 51     45/ 55     0/  0                **
3522   3  1      88        50/ 16     38/ 23     0/  0        **
```

[This report provides analysis on the performance of the Completion questions in the testbank. Question performance is identified for first attempts at a test, subsequent attempts at a test or supervised attempts at a test - and corresponding problems indicated by * in the last and third last columns].

APPENDIX D, Item 5

```
                                                                            Page
Report: 5.5.4          Analysis.Questions.Self_Generating               20-NOV-19
                              for Testbank JS2

                                                                      CATEGORIES
                                      1ST        SUB        SUP
MMOQO TT LL   #ISSUED               # / %      # / %      # / %    < 25   25- 85  > 85

 1419  5  2        4              3/  0      0/  0      1/  0      **
 1430  5  1       82             50/ 30     32/ 43      0/  0              **
 1431  5  1       89             58/ 32     31/ 58      0/  0              **
 1432  5  1       74             56/ 33     17/ 41      1/  0      *       **
 1433  5  1       77             55/ 45     21/ 71      1/  0      *       **
 1434  5  1       81             57/ 57     23/ 73      1/  0      *       **
 1435  5  1       88             63/ 49     24/ 75      1/  0      *       **
 1436  5  1       63             42/ 26     26/ 26      0/  0              **

 1511  5  1      234            174/ 10     60/ 30      0/  0      *       *
 1512  5  2        7              4/ 25      0/  0      3/  0      *       *
 1513  5  1      224            151/ 36     73/ 43      0/  0              **
 1514  5  2        7              4/ 25      0/  0      3/  0      *       *

 1605  5  1      238            167/ 46     68/ 63      3/  0      *       **
 1611  5  1      225            159/ 71     66/ 78      0/  0              **
 1612  5  1      185            132/ 68     53/ 71      0/  0              **
 1613  5  1      244            153/ 66     91/ 73      0/  0              **
 1614  5  1      208            133/ 60     75/ 58      0/  0              **
 1615  5  1      201            128/ 62     73/ 65      0/  0              **
 1616  5  1      209            151/ 61     58/ 72      0/  0              **
 1617  5  1      134            126/ 65     58/ 65      0/  0              **
 1618  5  1      226            160/ 63     66/ 66      0/  0              **

 2301  5  1      353            225/ 74    129/ 85      0/  0              **
 2302  5  1      329            237/ 67    161/ 73      0/  0              **
 2306  5  1      368            234/ 57    134/ 75      0/  0              **
 2307  5  1      369            224/ 60    145/ 79      0/  0              **
 2308  5  1      368            221/ 62    147/ 82      0/  0              **
 2309  5  1      407            260/ 61    147/ 79      0/  0              **

 3401  5  2       17             17/  5      0/  0      0/  0      *
 3402  5  2        5              5/  0      0/  0      0/  0      *
 3403  5  1      101             59/ 22     42/ 52      0/  0      *       *
 3404  5  1      111             44/ 25     67/ 59      0/  0              **
 3405  5  1       96             53/ 26     43/ 53      0/  0              **
 3406  5  1      104             51/ 27     53/ 56      0/  0              **
 3407  5  1      106             54/ 20     52/ 57      0/  0      *       *
 3408  5  1      113             56/ 17     57/ 54      0/  0      *       *
 3409  5  1       96             47/  8     49/ 42      0/  0      *       *
                                                                      Press <Return>
```

[This report provides analysis on the performance of calculation (problem solving) questions in the testbank. Question performance is identified for first attempts at a test, subsequent attempts at a test or supervised tests - and corresponding problems indicated by * in the last and third last columns].